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LECTURES

ON

THE PRINCIPLES AND PRACTICE

OF

SURGERY.

LECTURES

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THE PRINCIPLES AND PRACTICE

OF

SURGERY.

BY

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TO

THOSE WHO HAVE BEEN EDUCATED

AT GUY'S HOSPITAL,

AND TO THE PUPILS AT PRESENT IN THAT INSTITUTION,

IN WHICH THE AUTHOR HAS BEEN

FOR THE LAST TWENTY-FIVE YEARS

ACTIVELY ENGAGED AS A TEACHER,

This Volume is Dedicated,

WITH FEELINGS OF THE MOST SINCERE ESTEEM
AND REGARD.

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PREFACE.

It may be considered by many that a book upon Surgery is not at the present time one of the desiderata of the medical profession; and such a remark would, I think, be quite true, if it were intended to apply to a work on the abstract principles of the science. It is not without mature consideration that I have determined upon publishing the present volume; but I have come to the conclusion, that as its contents are of a practical character, embodying the experience of twenty-five years, during which time I have occupied the position of surgeon to Guy's Hospital, it would be found useful, not only to the student, but also to those who have entered upon the practice of their profession. It must be borne in mind, that it has not been my intention to write a systematic work on the elements of the science of surgery. These lectures were originally delivered before my hospital pupils; and in thus presenting them to the profession in a collected form, my object has been to furnish a useful compendium of surgery, in which the student may meet with a clear account of the practice of that science, established, not only on my own experience, but likewise upon the best acknowledged authorities. That the practice may not bear in some cases the character of empiricism, I have endeavoured, so far as I have been able, to lay down the general principles of science upon which the practice is based; at the same time I have avoided as much as possible any discussion of the hypotheses of the time, deeming my practical book an unfit medium for such matter.

In committing myself to the judgment of the profession, I do so with no overweening estimation of my own abilities, nor with an undue confidence of success. I feel that in many respects my work may be found deficient; but, on the other hand, I am encouraged to hope that there is much in it which will merit commendation. I have spared no pains in its preparation, and in its present form a considerable addition of matter has been made to that originally given in the lectures. It was at first my intention to call in the assistance of wood-cuts, but upon consideration, and a careful inspection of the best illustrated works, I abandoned the idea, from the feeling that such illustrations are generally very inadequate to their object, and that they too often mislead instead of informing the student.

Having completed the preparation of these lectures for publication, it now only remains to leave them in the hands of my professional brethren, that they may judge of their utility or otherwise. I do not in the least degree shrink from this ordeal. If the book possess the qualifications requisite in a work written professedly for the guidance of others in the practice of a difficult branch of science, I am sure that I shall receive whatever credit may be considered my due; if, on the other hand, it possess none of the advantages I claim for it, it is better that it should at once go into the oblivion which it would then deserve.

New-street, Spring Gardens.
October, 1851.

INTRODUCTORY LECTURE.

Gentlemen,

At the commencement of a fresh medical session, at a season which brings many new faces before me in my capacity of a public teacher, I am about to enter once more upon a course of instruction in one of the most important branches of the healing art, the Practice of Surgery. Before I begin, however, to speak of the subjects immediately connected with my lectures, there are some, which, although not directly forming part of the science of surgery, yet are so important to the successful study of that and every other branch of medicine, that I am disposed to devote a little time to their consideration.

Those among you that have now, for the first time, taken your seats in this theatre, will soon learn that in a public school the greater part of the information you will acquire, at least for some time, will be imparted to you in the form of *vivâ voce* teaching—a method which to most minds must be considered as possessing many advantages over learning from books, inasmuch as the lecturer is enabled at all times to adapt his mode of expression to his auditory, and to vary his illustrations and remarks according to the circumstances by which he finds himself surrounded. Moreover, lectures in most branches of science admit of a certain degree of practical illustration, which gives to the description of the lecturer a graphic character frequently wanting in written dissertations, and which, even if the lecturer be gifted only with moderate powers of communicating information, fixes the subject in the mind of the hearer in a manner not to be effected by words alone, no matter how forcible and apt the language may be. There are many branches of science which can only be taught practically—chemistry, for example; and this affords us a good instance of the value of illustrative teaching. It would be impossible to express by words alone the different changes of colour or physical character which occur in chemical experiments, and which constitute the text-book, so to say, of the chemist. A few practical illustrations, however, familiarizes the mind with the different appearances; a little practice initiates the learner in the manipulation; the consequence is, that through the eye the mind becomes rapidly and permanently impressed with facts that could scarcely be learned from books alone, even were a long and assiduous attention given to the subject. Verbal instruction possesses another advantage; it keeps the attention fully awakened to the subject of study—that is, if there be on the part of the pupil that proper and laudable desire to learn, without which no system of teaching will avail much. In studying from books, particularly if the style of the author be unpleasing and the subject one which addresses itself but little to the imagination of the reader, he is apt to become easily fatigued, and knowledge can, under such circumstances, only be acquired by a laborious effort of the mind. At the same time, practical teaching by lectures, be the subject what it may, must, to be useful, be both preceded and accompanied by judicious reading—preceded, because it is useful and necessary that the mind should be prepared beforehand with a certain amount of knowledge to enable it to receive, comprehend, and digest the information imparted by the teacher; for unless it be thus prepared, like a soil destitute of the elements of nutrition, it will be incapable of developing the seeds of knowledge which are cast upon it, and which will consequently wither and die away, without producing the fruit they ought to bear. It is also necessary that well-directed reading should accompany the attendance upon lectures; the reasons for this must be obvious. The time placed at the disposal of a lecturer in a public school of medicine,—such as our own, for example,—is far too limited to permit of the subjects being treated fully; the teacher is therefore compelled to seize the most salient points only, furnishing to the student a well considered and carefully arranged sketch, to which he must himself supply the details, the filling-in, as it were, from knowledge derived from reading and other means of study within his reach. It is perhaps more particularly to the younger class of students that oral teaching is beneficial, as it gives the lecturer the power of directing the manner of study and the choice of subjects, at the same time that the rudiments of science are being instilled into the mind of the learner. As the pupil advances, the advantages of reading and private study generally will, perhaps, be found to increase over those of learning by lectures, the mind will have been directed into the proper channels, and the impulse given in the first instance by the teaching of the lecturer, will have produced sufficient acquaintanceship between the learner and his subject, to enable him to approach it with familiarity; the first difficulties will have been removed; that which seemed an impenetrable mist has been, to a certain extent, cleared up; at all events, the student will have obtained glimpses of something beyond, worth a struggle for its attainment; the obstacles which appeared at first sight almost insurmountable have been overcome and set aside, and it has become evident that courage and perseverance alone are necessary to remove all asperities from the path, to render the rough smooth, the crooked straight. All this gives courage to the student; he is no longer liable to be frightened from his purpose by the impediments that oppose his progress, and which he knows are more than half conquered when they are boldly attacked.

Perhaps there is no branch of science in which oral teaching is more useful to the beginner than it is in surgery; during the first few months the pupil is prepared, by a judicious course of lectures, for the more practical part of his studies: his mind is far better trained by what he hears and sees in the lecture-room, to comprehend the value of the experience of the wards and operating theatre, than it could possibly be by reading alone, for these lectures emanating from practical men, have all a reality, a practical bearing, not usually met with in books. It must not be supposed that I undervalue the study of good authors; on the contrary, to become acquainted with the principles of the medical as well as the other sciences, close and attentive reading is positively necessary, and the choice of good books is a subject of more importance than the student may at first suspect. The reason that practical teaching is requisite to the acquirement of a knowledge of surgery is simply, that surgery is a subject in which the eye must be educated as well as the understanding, and this cannot be done by books alone.

There is a peculiar class of lectures to which I ought to refer here, as it is of the utmost value in connexion with the study of surgery, and indeed with that of the practice of medicine also: these are, clinical lectures. The importance of lectures of this kind must be obvious to all; the student is here in a situation to verify at once the statements of the lecturer, and perhaps the appearances and symptoms which characterize disease can in no other way be learned with equal ease and correctness.

Although it is my duty, gentlemen, to induct you to a knowledge of the principles of surgery alone, I cannot refrain, in an introductory lecture, from offering some remarks upon the general course of your medical education. It appears to me most arbitrary, I may say irrational, to attempt to draw, so strongly as is usually done, the line of demarcation between medicine and surgery; in point of fact, no such distinction can be maintained; the two blend with each other, and are mutually dependent. A disorder apparently constitutional is frequently cured by the removal of a local source of irritation, and an external disease, on the other hand, as often cured by constitutional remedies; it is therefore clearly necessary that the physician and surgeon should each understand the pathology of both the above conditions, or otherwise they must be in continual consultation.

It must be remembered, however, that surgery and medicine are both to be learned only through a knowledge of other branches of science. These, although apparently distinct from each other, and embracing subjects quite dissimilar, possess at the same time a close and mutual connexion; and indeed it is only in the relation of collateral branches of knowledge to each other that a consistent form is given to any science. "Omnes medicinæ partes ita connexæ sunt, ut ex toto separare non possunt."

The functions of every organized being, however low in the scale of creation, are performed through the medium and instrumentality of certain complicated systems of apparatus, each competent to effect some definite purpose. Both in plants and animals such apparatus or organs are alike found, and it is to their operation that the maintenance of those processes is due, from which results that mysterious and inexplicable condition termed vitality. In the higher animals, especially in man, the organs of the body are numerous and complicated in their structure and character, according to the function they are destined to perform, and their proper action depends upon their being in a healthy and natural condition. As it is necessary, before the mechanist can rectify the deficiencies of an injured or worn machine, that he should be thoroughly conversant with its structure, so is it necessary, before the medical practitioner can enter upon the treatment of a disorder of the human organism, that he should make himself fully master of its structure, and the relative position and connexion of its various parts. This study constitutes that branch of medical science called Anatomy. In a strict sense, anatomy signifies merely dissection; but more broadly, it may be held to comprehend the consideration of the structure of all organized matter, and, as some author has well said, may be regarded as the science of organization.

As the human frame is made up of parts differing from each other, but being still more or less essential to the well-being of the whole, the study of anatomy naturally forms the first subject of the student's attention. Suffer me, gentlemen, to earnestly impress upon your minds the importance of this study, not only in reference to the acquirement of a knowledge of the other branches of your profession, but also with regard to your future career as medical practitioners. The study of anatomy necessarily constitutes the groundwork of the science of medicine; and rely upon it, whatever the superstructure may be, a competent knowledge of anatomy forms the only sure foundation. Anatomy must, indeed, ever be looked upon as the basis of every branch of medicine; and it is to anatomical investigations that physiology and pathology owe their advancement to the prominent position they now occupy. There is no department, no branch of our profession which can claim exemption from the obligations due to anatomy; it is the guiding-star of the operative surgeon; and an acquaintance with its principles is of the greatest importance to the physician, in the estimation of internal and hidden disorders. The discoveries in anatomy have done much towards clearing away the mist of hypothesis and speculation with which medical science was at one time enshrouded, and it is from continued investigations in this branch of science that we may hope one day to see the practice of medicine, divested of the mantle of empiricism, take its place in the rank of exact sciences.

The object of the study of anatomy is twofold: it is subservient to the investigation of the structures of the body, both in health and disease. The first subject for the attention of the student, is the condition of the parts in a state of health; the changes which they experience under the influence of disease will be a matter for further inquiry, and belongs to the branch of study called morbid anatomy. As the anatomy of the body in health is the source of all that is positively known in human physiology, morbid anatomy must be regarded as the most essential element in the study of pathology; but in the beginning the learner is expected to deal only with the anatomy of health, to study the forms of parts, their relative situation and structural peculiarities.

When a sufficient insight has been obtained into anatomy, the study of Physiology will naturally follow; firstly, because physiological deductions are for the most part founded upon anatomical facts; and secondly, because physiology treats of the functions of the various organs with which the student will have become acquainted through the medium of anatomy. Physiology teaches, for example, that the function of the stomach is to prepare the food to be converted into blood, that of the liver to secrete bile, and that of the kidneys to withdraw excrementitious matter from the system in the form of urine. It is by means of physiological investigations that these processes have been rendered more or less intelligible, and that we can understand the nature of the action of different kinds of food, and of medicinal agents. Without a knowledge of the principles of physiology, anatomy is useless, the latter, as I have said before, treating only of the structure and relationship of parts, while physiology teaches what those parts are capable of effecting under the influence of vitality. Of late years the advances of physiology have been very rapid; this has probably arisen, in some measure, from the circumstance, that Chemistry has been made an adjunct to physiological inquiry. Vitality seems made up of a series of ceaseless chemical changes; the elements of the food taken into the stomach form new compounds, and are ultimately converted into the tissues of the animal frame; having performed their office, these are disorganized in turn, their constituents passing away as excrementitious matter. Chemistry, applied to physiology, has explained the nature of these changes: it has shown the relation which the different elements of the food bear to the life of the animal; that some are nutritious, convertible into tissue, and making up for the waste which is constantly going forward, while others only assist in supporting life by ministering to the process of respiration. Without a knowledge of physiology it is impossible to estimate the disturbances of function which are so generally indicative of disease, and one of the most valuable accessories to diagnosis is thus lost. By the study of anatomy and physiology the path will be opened for that of another equally important subject, Pathology—Anatomy being considered the science of healthy organization, Physiology that of healthy function, and Pathology that of disease.

In entering upon the study of Pathology, I must warn you, gentlemen, from the error of classing together pathology and morbid anatomy; the two, although intimately related, and tending to one object, are quite distinct. Morbid anatomy may be regarded as having the same relation to pathology as the anatomy of normal structures bears to physiology. Morbid anatomy discovers the changes which are produced by disease in organized tissues; pathology may be said to be the science of disordered functions, or of symptoms.

The study of morbid anatomy is essential to the proper comprehension of the laws of pathology, and, in many cases, an acquaintance with the effects produced in the system by alteration of structure is sufficient, in itself, to enable the surgeon at once to form a diagnosis. In such diseases as phthisis, morbus Brightii, aneurism, or enlarged prostate gland, the changes of structure are sufficient to account for the constitutional disorder attendant upon them; and here morbid anatomy furnishes the student with the most important data to his diagnosis, inasmuch as the urgency of the symptoms is generally in proportion to the extent of abnormal organic change. There are, on the other hand, diseases of important, nay even of the most dreadful, character, in which morbid anatomists have hitherto signally failed in discovering any structural change to which the disorder could be attributed. Hydrophobia and tetanus, perhaps the most fearful of all the maladies incidental to man, and at the same time the most violent in their symptoms, leave no trace of organic lesion from which their true seat and character can be deduced. The same may be said of fever and rheumatism, in both of which morbid anatomy fails to point out the "error loci." It is under these circumstances that the science of pathology comes in to our assistance, and teaches us to seek in symptoms and disordered function that information which we fail to derive from the aid of morbid anatomy. Let me therefore, gentlemen, urge upon you the necessity of a close attention to that part of your education which you will have to acquire in the wards of the hospital; to study closely the symptoms of disease, and the peculiar appearances of local lesions; for it is thus that you will have to learn pathology, and store up in your minds that experimental knowledge which will guide you in your future practice, and without which, devoid of any fixed professional principles, you will find yourselves constantly surrounded by doubt and perplexity. With relation to the study of morbid anatomy and pathology, I cannot refrain from alluding briefly to the advantages afforded by the employment of the microscope, and chemistry. In investigating the peculiarities of structure, the microscope furnishes us, as it were, with a new sense; it is impossible to arrive at anything like a correct idea of the character of the various tissues and fluids of the body without the assistance of this instrument; but with its aid, the student will be struck with wonder at the extent of the field of useful inquiry which will open around him. The study of the normal structures will, of course, prepare the way to that of the effects produced in different tissues by disease; and, indeed, in learning morbid anatomy, the student who does not acquire some knowledge of the use of the microscope, must be content to remain ignorant of a multitude of important facts, or at least take them by hearsay—a bad plan of becoming acquainted with any subject when we have the means of learning it by means of our own senses.

In relation to pathology, chemistry is also a powerful adjunct, and in some cases an essential one. In urinary disorders, in the examination of abnormal effusions, and, indeed, in a host of other cases, chemistry may become the chief means of diagnosis; and every student of medicine ought to acquire a sufficient knowledge of this branch of science, to enable him to make examinations for himself. I do not think that a large portion of time ought to be devoted to such subjects—there are other duties more onerous; but many a leisure moment may be well filled up in these (what I call) recreative studies. To return however, gentlemen, to the more relevant matter of my lecture. I have now described to you what ought, in my opinion, to be the course of study in respect to the commencement of the pupil's professional education. I have said, that the foundation of a knowledge of surgery and medicine must be the three branches of science I have spoken upon—viz., Anatomy, Physiology, and Pathology; but in these we have only the instruments by which future effects are to be produced; stopping here, the student will have done but little towards acquiring a knowledge of the practice of his profession. We must now see how he is to be trained in that branch of his education.

General medical practice, to which most of you will probably devote yourselves, requires a knowledge of the sciences both of medicine and surgery, and the object of all the training I have spoken of is to prepare the way to the study of these in the most legitimate manner. I have already said, that nothing is more arbitrary and artificial than the distinction which is drawn between surgery and medicine; but for the sake of convenience and perspicuity, I must now speak of them as separate.

Surgery, strictly speaking, means the art of manual operation; but it must not be supposed that the science of modern surgery consists of nothing beyond this. Cutting and mutilation are, perhaps, among the least important duties of the surgeon; a mere natural dexterity of hand would enable any man to become a skilful operator; but it is in the exercise of sound judgment in the discrimination of the peculiar points of a case, and in the skilful adoption of such means as will, when possible, obviate the necessity for an operation, that the good surgeon is chiefly shown. Some surgeons, from an unwise covetousness of fame, catch at every opportunity of performing an operation, making the suffering and danger of the patient a secondary matter of consideration. Let me warn you, gentlemen, against this manner of conduct.

Whenever it happens that you are placed in a situation in which it becomes your duty to employ your surgical skill for the benefit of a patient, do not be led away by the sole desire of distinguishing yourselves. The life of a fellow-being is in your hands, and depends upon your skilful performance of that task which you are about to undertake. Let, therefore, all your consideration be given to your patient, not only during the immediate operation, but also in his proper preparation before, and in his treatment after, the operation is completed. One rule should never be forgotten: be not too hasty in submitting a patient to the ordeal of an operation; for he is the better surgeon who saves a limb than he who cuts it off, no matter how skilfully the operation itself may have been performed; at the same time, manual dexterity in surgical operations must not be neglected. There are certain diseases, such as stone in the bladder, or hernia, which are beyond the reach of medicine; an operation alone can relieve the patient, and his safety can only be ensured by competent skill on the part of the operator. It does not invariably follow, however, that because a disease is incurable by medicine, a surgical operation should be had recourse to: the disease may be of such a character that its extirpation can only remove its external manifestations without removing its germs from the system. Sometimes, however, even under these circumstances, the removal of the affected part may be advisable for the purpose of diminishing the suffering of the patient, and even of prolonging his life, although there can be no hope of eradicating the disease or of preventing its return.

Some diseases, although causing disfiguration to the patient, may not interfere with any vital function; in such cases ought an operation to be resorted to merely for the purpose of removing a deformity? It is the judgment and acumen shown in points like the above, which distinguish the scientific surgeon from the mere operator. But, gentlemen, if it be right for the surgeon to pause before he brings the knife into requisition—if it be right that he should use his utmost endeavour to cure the disorder by medical appliances, he must evidently be somewhat of a physician; so it is, gentlemen, and this is one reason why all of you must study the science of medicine.

For you who enter into general practice there is a still more cogent reason; you will be most frequently called upon to act in the character of physician, and your duties will usually bring under your care the diseases which are supposed to belong most particularly to his science. Now, gentlemen, I believe there is but one way to become a good physician. Your preparatory studies, as we have seen, relate in an equal degree both to surgery and medicine; but to learn the practice of the latter nothing but personal experience and acute observation will serve. Symptoms can only be learned at the bedside; and I believe it to be perfectly impossible for any one to gain a knowledge of the principles of diagnosis otherwise than by practical teaching. So with the properties of remedies: their chemical character you may learn in a great measure from the writings of others; but the action of these remedies upon different constitutions, the modifying influence of diathesis and of diseased action, can only be learned in the hospital wards. And let me beg of you to look upon this as the most important point of all in the education of the medical student; all other studies tend to the one object—to make a skilful practitioner. But you may be perfect anatomists, excellent physiologists, and possess a competent knowledge of the laws of pathology; you may be skilful chemists, and well conversant with the science of botany, and the properties of materia medica; but all this does not make a physician. A practical acquaintance with symptoms and characteristic circumstances, to be learned only by patient and long-continued observation by the bed-side, is imperatively required; and I trust, gentlemen, that you will perceive the importance of this branch of your studies, and lose none of the excellent opportunities you here possess of acquiring a knowledge so essential to your future success.

LECTURES

ON THE

PRINCIPLES AND PRACTICE OF SURGERY.

LECTURE I.

Reason for choice of blood as commencement of a surgical course—Importance of the blood—A living fluid—Necessity for replenishment of blood—Ingesta—Albumen, fibrin, and casein—Hydrocarbons. Quantity of blood in the human body—Effects from loss of blood—Greater from arterial than venous—Syncope not always to be feared—Colour of arterial and venous blood. Time required for the whole quantity of the blood to pass through the heart. Conditions of healthy blood—Specific gravity—Red particles—Liquor sanguinis—Coagulation influenced by heat—Proximate elements—Red particles—Fibrin—Albumen—Salts—Water—Buffy coat.

GENTLEMEN—

IN pursuance of the plan which I propose to follow in these lectures, I shall commence with some observations upon the Blood. To many of you it may appear singular that I should have made choice of the blood as the first subject in a course of surgical lectures; but when I have explained to you the various important purposes this fluid is destined to fulfil, during the progress of the growth of the body, in the maintenance of its health, and in its restoration from disease, you will all, I think, readily admit the necessity of understanding the normal state of the blood, that you may appreciate the changes to which it is liable under the influence of various morbid conditions.

I do not intend to enter deeply either into the chemistry or physiology of the blood, but merely to bring to your notice such points on the subject as have reference to practical considerations. It is worthy of remark, that in the earliest times the blood was considered a highly important and vital fluid, for in the book of Leviticus we find it written, that "The life of the flesh is in the blood; the blood is the life of all flesh, the blood of it, is for the life." John Hunter, the prophet of surgery, seems to have been impressed with this conviction, and always spoke of the blood as a "living fluid."

As the increase of the body, the development of its organs, and the supply of its waste, depend entirely on the blood, the quantity of this fluid must necessarily be constantly diminishing, and require, therefore, replenishment. This is accomplished by the introduction of those substances into the stomach which are capable of being converted into blood; but whatever variety of food may be employed, that only can renew the blood, and consequently nourish the body, which contains one or other of the three animal constituents termed *fibrin*, *albumen*, and *casein*. These contain nitrogen, and are found in both animal and vegetable substances. It is true other elements enter into the composition of the various articles employed for the food of animals; such as starch, gum, sugar, fat, &c. None of these, however, contain nitrogen; they are termed therefore hydro-carbons; and, although not alone competent to the nourishment of the body, they perform the very important office of supplying the materials for the production of the animal heat, and are therefore essential to the preservation of health. Hence it is that in cold climates we find the inhabitants require large quantities of oil, fatty substances, and alcohol, to supply the heat which is constantly being abstracted from the surface of the body.

When we consider the great use of the blood, a natural desire arises to learn the quantity of this fluid which is contained within the human body; but this is very difficult to ascertain correctly. Various methods have been adopted to solve this question; such as bleeding an animal to death from the aorta, chopping an animal to pieces, and squeezing out the blood: but such experiments have produced only uncertain results. Valentin, however, adopted a much more ingenious and scientific experiment. He withdrew from an animal an ounce of blood, and substituted for it an ounce of a solution of a salt of known strength; after a certain time he drew off another ounce of blood, and, ascertaining the quantity of salt contained in it, he determined the quantity of blood within the animal. Although this experiment is not free from objections, still it seems to be one of the best which has been adopted for the purpose. Applying his results to the human body, he has deduced, that a man of thirty years of age contains about thirty-four pounds of blood, and a woman of the same age about twenty-six pounds. There is, however, reason to believe that Valentin has overstated the real quantity of blood at any one time flowing through the vessels of a human being; and this suspicion is strengthened by the fact of the danger resulting from the loss of only a small proportion of the mass he conceives to be always circulating.

The abstraction of twenty ounces of blood produces a very great effect upon the constitution, although the danger arising from this source is not wholly attributable to the quantity lost, but partly to the velocity with which the blood flows. The loss of arterial blood is more dangerous in its effects than that of blood from the veins: this results principally from the greater quantity of nutritious matter withdrawn, but in some measure also from the rapidity with which it flows. Such facts as I have now mentioned should be constantly borne in mind in the regulation of your practice in the abstraction of blood as an antiphlogistic remedy. Cases are recorded in which seventy ounces of blood have been withdrawn at one bleeding, but, fortunately for mankind, physiology is now considered an essential branch of medical education, and much less hazardous means are employed to produce the intended effects. When a large quantity of blood has been lost, a quantity beyond which dangerous results would arise, syncope very generally ensues; this is a state in which the blood ceases to be propelled through the smaller vessels, and in which there exists a tendency to its coagulation, with a consequent closing of the wounded vessels. A judicious surgeon therefore hesitates before he interferes with this natural attempt to check the loss of blood; but at the same time it is to be borne in mind that the syncope may remain to so lengthened a period as to render it advisable to produce reaction by the administration of stimuli, especially when a very large quantity of blood has been drawn before syncope occurred.

The colour of the blood varies in animals of different kinds. In mammalia, birds, certain reptiles, and fishes, it is red; in the invertebrata (with the exception of some annelidæ) it is white; while in other animals it is even of a bluish colour. In man the colour of the blood, as all of you must be aware, differs in the arteries and in the veins: that in the former system of vessels being of a bright scarlet, and that in the latter of a dark modena red, although the size and form of the red particles are the same in each. This physical characteristic of the two kinds of blood is often a sign of great importance to the surgeon in cases of hæmorrhage, especially during surgical operations; but he should be aware that it is not an invariable evidence of the source from which blood is flowing: for when the blood is retarded in its passage through the arteries, it will assume a venous hue; and so also under certain circumstances, venous will retain the colour of arterial blood; indications which, when appreciated, regulate the practice to be adopted in each instance. It would, for example, be difficult to decide at once whether the blood in this saucer be arterial or venous, for it has so long been exposed to the atmosphere that it has absorbed a sufficient quantity of oxygen to have acquired a scarlet colour, and here is a demonstration, therefore, of the difficulty I have alluded to.

The passage of the blood through the heart and blood-vessels is termed its circulation; and this transmission of the blood from one part of the system to another, takes place with great rapidity. The quick rate at which the blood circulates, has been demonstrated by Hering's experiments, who found prussiate of potash in the saphena vein of a horse in twenty seconds after he had injected it into the jugular vein, and within thirty seconds it was found in the other jugular. The time required for the whole mass of the blood to pass through the heart, has been calculated by several different authorities; but the calculation of Müller seems to me to be founded upon the most rational data, and therefore to approach very closely to the truth. Müller considers that 2 oz. of blood are expelled from the left ventricle of the heart at each systole, and 25lbs. is his highest calculation of blood in the body, so that at 75 pulsations in a minute it would require $2\frac{2}{3}$ minutes for the whole of the blood to pass through the heart.

Many circumstances affect the blood during its circulation through its proper vessels, and may tend to alter the relative proportion of its constituents, and thus exert a most powerful influence in modifying and aggravating disease. The blood passes from the heart into the arteries; these are destined to convey it to their terminating branches, the capillaries, from which its constituents are transuded for the supply of every structure in the living body: for this function to be healthily and properly performed, the integrity of the blood must be implied, the action of the arteries and capillaries be normal, and the tissues healthy, to enable them to receive their due supply of nourishment. The whole system is otherwise put out of order. As all the blood contained within the capillaries is not expended in the supply of the tissues of the body, it is returned as deteriorated blood by the veins (assisted by the absorbents) to the right side of the heart, receiving in its refluent course a fresh supply of nutrient ingredients resulting from the digestion of food; and subsequently throwing off its effete matter through the action of various organs destined for this excretory office, it ultimately receives a fresh supply of oxygen from the lungs, when it may be said to be renovated, and fitted again for circulation.

Thus we must consider the human body not as an inanimate but as a vital mass, not in a state of rest but in constant action and change, and we can but regard the blood, from the first formation of the embryo to the period of senescence, as the great pabulum of life.

Wonderful and important as are the functions of the nervous system, it is supported by the blood, and without the influence of the blood it is incapable of directing motion and receiving sensation. The immediate effect produced on the nervous system by cutting off the supply of blood to the brain, was first demonstrated by Sir Astley Cooper, who, by compressing the carotid and vertebral arteries of an animal, deprived it of life in two minutes. The rapid dissolution so frequently resulting from hæmorrhage is but another illustration of the same fact.

The blood is not only important under the view which we have taken of it in health, but equally so in disease; for we find that it undergoes, either as cause or consequence, appreciable changes both as to quantity and quality; and in order to understand these morbid conditions it is quite necessary to be acquainted with the nature of this fluid in a state of health.

Condition of healthy blood.—The specific gravity of healthy blood is from 1.050 to 1.060, its temperature varying from 98° to 100°; facts not unimportant, as they alone may tend, under certain circumstances, to assist you in the diagnosis and treatment of disease.

The blood appears, to the naked eye, a homogeneous fluid, but if examined under a microscope, it is seen to be composed of numerous little red disc-shaped corpuscles, floating in a colourless fluid, "the red particles" and "liquor sanguinis;" the latter term having been first applied to this fluid by my colleague Dr. Babington, to distinguish it from the serum, which is the fluid part of the blood after the fibrin has been spontaneously separated from it by its coagulation.

Some time after blood has been withdrawn from a living animal, it begins to gelatinize or coagulate. The coagulation of the blood is owing to the spontaneous consolidation of its fibrin. The period at which the consolidation takes place depends on the temperature of the medium to which the blood is exposed: this fact may be a consideration of importance to a surgeon, suggesting the propriety of regulating the temperature of a room during surgical operations, for it has been ascertained that blood withdrawn from a vein in the arm, in a room at the temperature of 53°, coagulates in 4.5 minutes; at the temperature of 98°, in 2.5 minutes; and that blood which coagulates in 5 minutes at 60°, remains fluid for 20 minutes at 40°, and requires 60 minutes for complete coagulation; these experiments were instituted by Dr. Scudamore. The self-coagulation of the blood Hunter found to be materially influenced by its admixture with foreign substances. This has been corroborated by other experimenters, and it has been found that certain morbid secretions, above all, pus, are capable of producing a powerful effect upon the coagulation of normal blood. Pus added to freshly drawn blood hastens coagulation, and if the pus be in a putrid state, it acts more energetically than if it be fresh. Pus introduced into the veins of the living body tends to produce coagulation of the blood, as in phlebitis; an action which operates as a means of preventing the pus from entering into circulation, isolating it and confining it to the locality in which it was first introduced or formed. From researches which have been made on this subject, it appears that pus coagulates blood in the living vessels more rapidly than after it has been withdrawn from the body.

The readiness with which the blood coagulates when any irritating fluid is injected into the veins, will probably account for the fact that under such circumstances the constitutional symptoms that might be expected, do not always supervene; but if there be no coagulation of the blood, or if an obstruction to the passage of the blood through the blood-vessels be formed at first, and afterwards broken down, as may happen, then constitutional disturbance of greater or less intensity will ensue.

The following diagram points out the changes which the blood undergoes by its coagulation:—

$$\text{Liquid blood}\left\{\begin{array}{l}\left.\begin{array}{l}\text{Red corpuscles . . . .}\\ \text{Liq. sanguinis}\left\{\text{Fibrin}\right.\end{array}\right\}\text{Clot}\\ \qquad\qquad\qquad\quad\;\;\text{Serum . . .}\end{array}\right\}\begin{array}{c}\text{Coagulated}\\ \text{blood.}\end{array}$$

It is, then, to be observed that by the act of coagulation the blood separates into a fluid and solid portion; and this phenomenon occurs whether the blood be exposed to the air, or in vacuo, under the influence of heat or cold, whether at rest or in motion, and even where it has been extravasated in the living textures of the body: under each of these circumstances, however, some modifications occur both as to the period at which coagulation takes place, and the complete separation of the solid from the fluid parts.

The proportion of the quantity of serum to that of the crassamentum in healthy blood, is three-fourths of the former to one-fourth of the latter, but it is found that considerable deviations occur under disease and after loss of blood; so that the proportion of the two to each other is a most legitimate object of investigation to the pathologist.

It is also a remarkable fact, that the shape of the vessel which receives the blood influences very considerably this separable proportion. Thus, Dr. Babington received, at the same bleeding, some blood into a pear-shaped bottle, and some into a common basin; in the former the serum was to the crassamentum as 10 to 15, in the latter, as 10 to 22.

I beg leave now, gentlemen, to draw your attention to this table, in which the *proximate* elements of the blood, and their proportions to each other in a healthy state of the fluid, are set down.

It has been found by Lecanu that a thousand parts of blood contain of—

Red particles	127
Colourless particles in very small number.	
Fibrin	3
Albumen.	72
Salts	8
Oil	Trace
Water	790
	1000

As each of these constituents performs most important functions in the animal economy, I shall speak of them separately.

The *red particles* in the human subject consist of globuline, mixed with red colouring matter, contained in a capsule. They differ in form in different animals; in man they are circular biconcave discs, about $\frac{1}{3200}$ of an inch in diameter. In individuals of the same species of animal they are essentially the same, excepting in the human embryo before the liver is formed. In all vertebrata, the shape of the blood globules is well defined; but this may be somewhat modified according to the size and fullness of the vessel in which they are circulating, and the tenuity or density of the liquor sanguinis.

The red particles being the heaviest constituent of the blood, their increase renders that fluid specifically heavier. Frequent bleedings diminish the specific gravity of the blood, in consequence of the other constituents being more rapidly reproduced than the red particles.

The specific gravity of the serum of blood in a morbid state has been much better ascertained than that of the whole of the fluid as it is drawn from the veins; it has been found that the quantity of saline matter usually present does not raise its specific gravity more than five parts in a thousand above that of distilled water; and that the excess of specific weight depends upon the presence of albumen. In Bright's disease, in which albumen is rapidly carried out of the system, the specific gravity of the blood is sometimes reduced as low as 1.013; while in cholera, it is often as high as 1.041.

It is supposed to be through the medium of these corpuscles that the animal heat is generated and maintained, and, according to the theory of Professor Liebig, entirely by a chemical action: he describes the iron of these corpuscles to be in a state of protoxide, and that it becomes converted into a peroxide in its passage through the lungs. The oxygen thus obtained combines with the carbon of the various tissues of the body during its systemic circulation, and thus carbonic acid is formed, the union of the carbon with the oxygen generating the animal heat. This carbonic acid being given off again in the lungs, restores the iron to its former state of protoxide—a condition the most favourable to the re-absorption of oxygen from the atmosphere.

The temperature of the blood is materially influenced by disease, especially by fever. Wilson Phillip found it as low as 74° F., in the cold stage of ague, and 105° in the hot. Morgagni speaks of the blood flowing from the veins of a woman icy cold—the serum was of a yellowish colour, and the crassamentum black. Thackerah mentions the same thing. Haller states, that in intermitting and continued fever the temperature of the blood was as high as 102°, 104°, 108°, 109°, F.

It is impossible to contemplate the particular function these corpuscles of the blood are destined to perform in the animal economy, without anticipating at once how many of the familiar phenomena connected with both constitutional and local diseases must depend upon their healthy condition; and more especially when we observe what a large proportion these constituents bear to the other proximate elements of this fluid. For instance, when superabundant, an increase of animal heat and redness of surface results, with vertigo, tendency to hæmorrhage, &c. If there be a diminution of their just proportion, coldness and paleness evince the condition termed anæmia, and the treatment is at once indicated to restore the balance and due proportion of the red particles to the system, as they constitute the oxygen carriers of the blood, and are therefore especially connected with respiration and animal heat.

Hæmatosine, one of the constituents of the red corpuscles, is perhaps the most unchangeable substance contained in the blood; it is, however, subject to some variation as to quantity. In hæmorrhage, the hæmatosine diminishes very rapidly, and is but slowly reproduced. The character of hæmatosine seems to undergo some peculiar change in malignant diseases, such as melanosis, and where the blood is found to retain its fluidity after death from poison, lightning, &c.; the hæmatosine appears to become soluble in the serum, and stains the lining membrane of the vessel which contains it.

Fibrin.—This constituent stands next in order for our consideration, and perhaps may be considered by the surgeon as a more important ingredient than even the red particles, for it is by the exudation of fibrin from the bloodvessels that all lesions are healed. That this power of restoration of a wound should not be invariably the same, may readily be conceived, when it is understood that the proportional quantity of this plastic matter depends upon the general constitutional condition of the individual, being found to vary both in quantity and quality under different states of health: it is, in fact, by this plasma that many of the structures of the body are originally formed and maintained in a state fitting them for the performance of their various functions, and that, when subjected to injury, they are repaired. Just as the red particles are the constituents of the blood essential to the functions of respiration and animal heat, so may the fibrin be considered as acting the important office of the nutrition of the body; hence, in the blood of new-born children, while those parts of the body of which fibrin constitutes a large proportion are yet but little developed, but a small quantity of fibrin is found; but in youth and adolescence, while nutrition in every part of the body is being carried on with an activity greater than at any other period of life, the largest quantity of this constituent is developed, and at this period of life injuries are most readily repaired. Self-coagulation is the peculiar inherent attribute of fibrin, and was adduced by John Hunter as an evidence of the vitality of the blood. A wound recently inflicted by a cutting instrument is not, however, reunited by the fibrin of the effused blood, although there is reason to believe Hunter did consider such to be the fact, as implied by his term of adhesion by the "first intention." The following seems to be the process by which a wound is united by adhesion: the blood which is thrown out coagulates, and covers the truncated tissues—probably a very essential provision towards reparation; the serum and red particles are absorbed, leaving a whitish clot or film—the fibrin; whilst, as a result of the supervening inflammation, a tenacious diffluent secretion is thrown out by the surrounding capillaries, termed plasma, or coagulable lymph, and which is, in fact, identical with the fibrin. There is reason to believe that the plasma of effused blood will, under certain circumstances, become organised, and repair an injury at once. In the Hunterian Museum of the Royal College of Surgeons there are some preparations of the fibrin of extravasated blood having become organised. I do not mean to imply, however, that all wounds are healed by this process of adhesion; for, when there is much loss of substance, another process must inevitably be performed.

In certain diseases, the fibrin of the blood seems to undergo some peculiar change, both in quantity and quality: in a hæmorrhagic diathesis, for instance, it is scarcely at all coagulable; and this is, perhaps, the case in hæmatemesis, and when blood passes away by the bowels. The fibrin of the blood separates the more readily, in proportion as the nervous energy is diminished. Thus, when an animal is bled to death, the later portions of blood withdrawn coagulate more rapidly than those taken at first.

Albumen forms a very principal constituent of the serum: it does not possess the power of self-coagulation like the fibrin, nor when coagulated does it present the same fibrous arrangements; but it is very similar in chemical composition. It is believed by some, that the albumen of the serum is held in solution and prevented from self-coagulation by the saline matters of the serum, while that portion termed fibrin, which spontaneously coagulates, is the quantity beyond what the salts can retain in solution; it separates, therefore, from the rest of the blood in coagulation. Liebig is of opinion that albumen and fibrin are readily converted into each other—in fact, that they are isomeric; and this view seems to be strengthened by the sudden changes which blood undergoes during its evacuation, as well as from the rapidity of the formation of fibrin under peculiar constitutional and local conditions. Müller denies their isomerism, and attributes an atom more of sulphur to the albumen. Whether convertible into each other or not, it seems that the albumen, without undergoing any change, constitutes a considerable portion of many structures: of those, perhaps, which are less highly organised than such as derive their nourishment from a supply of fibrin.

The important influence of the albumen in the animal economy is sufficiently evinced by the fact that its removal from the system, as in albuminuria, leads to such symptoms as would be expected to accrue from the loss of an equal quantity of fibrin. Surgeons ought therefore carefully to examine the state of the urine before they submit their patients to surgical operations; for, if that fluid be found to contain much albumen, but little hope could be entertained that the individual would sustain the shock of the operation, or at any rate survive the ineffectual attempts at reparation. Dr. Bright has most ably brought before the profession the pathology of this affection, and has indeed given so graphic a history of the appearance of patients suffering under albuminuria, that one can scarcely overlook the pathognomonic signs of the disease.

It has not yet been shown that albumen is capable of undergoing any modification by disease, which can prevent it from coagulating under the influence of heat. Its relative quantity in the blood may be increased or diminished; and when the quantity of fibrin is abnormally large, that of the albumen is proportionally lessened—a circumstance which supports the idea that these two principles may be mutually convertible into each other.

Salts of the blood.—I here show you, gentlemen, the saline matters of the blood procured by incineration, for I think it is better that the eye as well as the ear should convey to you a knowledge that such inorganic substances are present in this fluid. They are composed of chloride of potassium and sodium, sulphate and carbonate of potash and soda, phosphate and carbonate of lime an iron. It is believed that one of the principal uses of these salts in the blood is to maintain the fluid condition of the fibrin; for it has been observed by pathologists, in those diseases in which there is a deficiency of serum in the blood, and consequently of these saline matters, that the blood has been extensively coagulated in the heart and large vessels; and from this fact arose the proposed plan of the injection of saline solutions in cases of cholera. A very small quantity of saline matter mixed with freshly drawn blood will prevent its coagulation; from which experiment it may be inferred that any deviation from the due proportion of these salts must alter the natural condition of the blood.

The salts of the blood have been chiefly examined, in pathological relation to that fluid, by Dr. Stevens. He found the normal quantity of these constituents much reduced in tropical fevers, and in malignant cholera: on the other hand, they are present, in some cases, in unnaturally large quantity; this is marked by their superabundance in the urine, and by great excitement in the circulation. When this excess of saline matters exists, they have also been found, after death, deposited in an aneurismal sac.

Oily and fatty matters may be obtained from blood by treating freshly drawn blood with boiling alcohol and ether: the alcoholic solution will yield a crystalline fatty deposit, and the ethereal solution the oily matter. I believe but little is known of the use of this constituent, and it seems to be taken up by the blood under circumstances of its excess in the system, in cases of obesity; therefore exercise and spare dietetic treatment would be indicated by its presence.

The comparative quantity of oil seems to increase in some diseases, and to give to the serum of the blood the milky appearance it sometimes presents. Hewson mentions this, in a case of amenorrhœa, complicated with dyspepsia and vicarious discharges of blood by vomiting and stool. Dr. Babington also mentions it, in a case of diabetes; and Sir Astley Cooper found a similar condition to exist in the fluid of a hydrocele. Oily serum seems to be always deficient in albumen. It is, therefore, a question whether, under some circumstances, fat may not be derived from the albumen, in consequence of decomposition of the latter substance.

Water of the blood.—The specific gravity of the liquor sanguinis is kept at its healthy standard by the dilution of the four last-described ingredients with a due quantity of water; and so accurately is this balance required to be maintained for the preservation of health, that any notable change in the specific gravity of the blood is certain to be attended with some abnormal symptoms. The principal remedial means to be employed to restore the blood to its natural state, are through the medium of the organs of digestion and lungs, with due attention to the excretions, at the same time administering such remedies as may be indicated by an excess or deficiency, either of certain constituents of the blood, or of the whole mass of this fluid. Thus, for instance, in hyperæmia, in which the red particles of the blood are found far to exceed their normal proportions, and which is accompanied by a florid complexion and increased excitability, low diet, depletion, mercury, colchicum, and such medicines as increase the secretions generally, are indicated: while, on the other hand, in the opposite condition, in which is to be observed the pallid complexion, general debility, and retardation of all the natural functions, with the exception, perhaps, of circulation, which may be hurried, though weakened, the treatment indicated is just opposite to that of hyperæmia; and nourishing diet, gentle exercise, pure air, with administration of steel, will be found the best means of removing this anæmiated condition. These states, gentlemen, are quite as important in the consideration of the surgeon as of the physician; for under such derangements a patient would be altogether unfitted to sustain the shock of any surgical operation, or to repair any local injury he might have sustained, unless means were judiciously employed to improve the constitutional powers. It is the duty, therefore, of every surgeon, before he submits a patient to an operation, closely to investigate his state of health with reference to his powers of assimilation, the normal action of his heart and lungs, and the general state of his excretions; the operator will otherwise find, when his discovery will be too late, that, however dexterously the operation may have been performed, the art and science of surgery are two very different classes of study, and that manipulation will avail little, if his sense, as well as his senses, have not been exercised.

I shall say a few words, gentlemen, on the condition of blood termed its buffy coat, sometimes found soon after it has been withdrawn from the body. I mention it principally because it has been too frequently considered that, so long as this state is observed, so long may blood be abstracted, and strict antiphlogistic means adopted. This rule, however, must be followed with caution, for it may be frequently observed that the first portions of blood drawn do not present this phenomenon, and yet it may appear upon every succeeding quantity abstracted. John Hunter considered that it indicated inflammation, under the influence of which he supposed the blood had a diminished tendency to coagulate, and allowed, therefore, the red particles to subside through the liquor sanguinis, leaving the buffy coat above the red deposit. Later observations tend to show, however, that retarded coagulation is not the cause, but that the buffy coat is mainly owing to an increased quantity of fibrin, rendering the liquor sanguinis more viscid; whereby the attraction and cohesion of the red particles to each other are increased, they therefore subside with an increased velocity. Anything which increases the viscidity of the liquor sanguinis thus hastens the descent of these particles; this has been proved, by Mr. Gulliver, among others; he ascertained that, by the addition of a little mucilage to freshly drawn healthy blood, he could hasten the subsidence of the red particles, and quickly produce the buffy coat, retarding, at the same time, the coagulation of the fibrin. Mr. Gulliver found that the abstraction of the red particles from the liquor sanguinis checked the spontaneous coagulation of the fibrin. He also found that the addition of the red particles to healthy liquor sanguinis hastened the coagulation of the fibrin in about the same proportion as their removal retarded it. It may be considered, perhaps, as a further argument against the buffy coat being an inflammatory indication, that blood abstracted by Sir Astley Cooper from a patient suffering from scurvy, was found to form a very strong buffy coat.

LECTURE II.

Of the bloodvessels, and absorbents—Arteries—Capillaries—Veins—United functions of these vessels assisted, probably by the nervous system—Pathology of arteries as far as relates to physiology—Hypertrophy—Hæmorrhagic diathesis—Pathology of veins—Phlebitis—Pathology of the capillaries—Pathology of the absorbents—Inflammation—Predisposing causes—Idiosyncrasy—Temperament—Diathesis—Exciting causes—Chemical causes—Cold—Phenomena of inflammation.

Having treated of the healthy and abnormal conditions of the blood, as connected with the science of surgery, I shall now proceed to describe the vessels which are destined to circulate the blood through the living body.

The arteries.—The arterial distribution of the blood is performed, as has been already stated, for effecting the purposes of the growth, and peculiar nourishment of each individual part of the body; and as the nature of the blood which is distributed through these vessels is in every situation the same, while the constituents of the various tissues are so different, it is a necessary consequence that the arteries should terminate by some peculiar arrangement, possessing the vital power of appropriating those constituents only of the blood suited to each tissue; and such an apparatus is found in the capillary system. It is clear, therefore, that any abnormal change in the arteries, interfering with the circulation of the blood through them, must also interfere with the appropriating power of the capillaries and normal condition of the tissues.

The capillaries.—In a physiological point of view the capillary is by far the most important part of the circulatory system, being in fact the seat of all the principal functions, as well of the phenomena of healthy and diseased action. The capillaries are so delicate and transparent that they can only be demonstrated with the assistance of a microscope, from the blood they contain, which may be observed to flow from the arterial extremities in every direction, though ultimately to terminate in the commencing veins. The capillary vessels are thus placed between the terminations of the arteries and the commencement of the veins, constituting an intermediate delicate net-work. Through their parietes the constituents of the blood exude. As these vessels are invariably accompanied by absorbents and nerves, it is yet to be ascertained to what proportionable extent the nervous system influences the proper appropriation of the blood. As the whole quantity of the blood which is conveyed by the arteries to the capillaries is not consumed, but changed only, both in quantity and quality, another set of vessels is required to convey the remaining portion of the blood back again to the heart, and these vessels constitute the venous system.

The veins are not merely for the purpose of conveying the refluent blood which has been distributed throughout the body for the various purposes of life, but also to receive the product of absorption which is poured into them just before their large terminating trunks enter the right auricle. The contents of these absorbent vessels, which are received by the veins in their course towards the heart, are of a compound nature; one portion being nutrient and fitted to be converted into blood, while the other portion is effete matter, detrimentary to the blood, and requiring, therefore, that it should be submitted to the influence of respiration before it can again be sent to the arterial system.

Hence it may be inferred that the arteries, veins, and absorbents, together probably with the brain and nerves, are all subservient to the functions of the capillary system, to which the phenomena of health and disease, and the action of therapeutical agents are chiefly referable. These remarks may perhaps be considered as more suited to lectures on physiology than surgery, but I would ask how are we to understand the diseased actions of these systems, if we do not comprehend their normal conditions, which are best indicated by the natural performance of their several functions.

We will now consider, therefore, some of the diseases of the bloodvessels which interfere with the performance of these important functions, and tend to a diseased state, either in themselves or in the blood which they contain, the capillaries which they supply with blood, or the tissues which should be duly nourished.

PATHOLOGY OF ARTERIES.

I shall now only speak of the changes of these vessels which tend to interfere with their power of supplying the capillary vessels with nutrient blood, and postpone the surgical part of the subject, as distinguished from the physiological pathology, to a future consideration.

The healthy condition of the arteries is maintained by a capillary system of their own, the "vasa arteriarum," as it is termed; and on the integrity of these vessels the healthy condition of the arteries depends, while any alteration in the distributing power tends to a morbid change in their coats, altering their physical and vital conditions. Each coat of an artery has its especial nutrition, which appears to be necessary in consequence of their differing so widely as to physical condition and function; each coat has therefore its particular and independent system of capillaries, and each is subject to lesions peculiar to itself.

Hypertrophy is one of the most frequent changes to which the arteries are liable; but this is not always to be considered a diseased state, as it is found to be inseparable from that natural excitement induced by the necessity of a sudden growth or continued action of any part of the body; hence it is found in certain vessels of the human subject at the age of puberty, during the development of the organs of generation, also during utero-gestation, and in the muscles of a limb which is submitted to any continued peculiar exertion, as may be observed by the increased size of a blacksmith's arm: but the same condition may result from an over-action of the heart, from augmented power of assimilation, leading to hyperæmia; or from, what we as surgeons have more to do with, local injury. The hypertrophy resulting from external violence is, there can be little doubt, a very similar condition to that of vessels under the stimulus of the growth of a part; the former, indeed, may be considered as a reparative, and the latter as a formative action, but either of them may lead to a diseased condition; if the distention of the vessels be beyond what their natural tonicity can support, they become dilated, and an altered condition, both of the blood-vessels and the blood contained within them, is established, leading to the necessity of medical treatment for their relief.

To demonstrate that hypertrophy of arteries is not always to be considered as a malady, I have, gentlemen, only to draw your attention to this preparation, in which the external iliac artery has been tied, and the circulation of the limb has been carried on, as you may observe, by these hypertrophied collateral branches, which would have been quite unfitted for the office they performed but for their enlargement.

Hæmorrhagic diathesis is by some pathologists considered to depend upon a diseased state of the arteries; but although it is true that these vessels seem to be both physically and vitally affected, as may be observed by the difference in the appearance of their tunics, and from their indisposition to contract, it has yet to be proved that this is not really an effect, instead of a first cause, induced by a diseased condition of the vasa vasorum. I have known persons the subjects of this disease (which, by the by, is frequently hereditary) bleed nearly to death from the drawing of a tooth or some slight incised wound. It is, therefore, incumbent on a surgeon, whenever he experiences any difficulty in restraining bleeding, especially if it occur from a slight cause, to investigate the constitutional condition of his patient, and to correct the diathesis, if it be present.

The coats of arteries are liable to many kinds of degeneration; but as they so frequently lead to aneurism, I shall leave the description of these morbid changes until I come to the consideration of that disease.

Pathology of Veins.—The coats of veins are nourished by a peculiar capillary system similar to the *vasa arteriarum.* Veins may, like arteries, become hypertrophied actively from the influence of the dilatation of the arteries under the stimulus of formative excitement, or passively from an impeded circulation of the blood through them, constituting varix.

In these pathological relations the veins closely resemble the arteries: but it is important to remark that they are not subject to any morbid condition precisely answering to aneurism; this arises from the difference between the physical characters of the coats of an artery and those of a vein: the arterial coats yield gradually to the internal pressure from the blood, the coats of a vein yield at once. There are certain morbid conditions which are much more frequently met with in the veins than in the arteries; for instance, the blood is much oftener found coagulated and organized in veins than in arteries; pus is also most commonly seen in the veins, and indeed the veins appear to be more liable to inflammation than the arteries. How much more frequently have we occasion to employ the term phlebitis than arteritis!

Inflammation in a vein is generally attended with local pain and constitutional disturbance; the vein soon becomes as firm as if it contained solid matter, and more or less œdema of the limb follows. The hardness of the vein results from the coagulation of the blood within it, and the thickening of its internal coat. The same, or at any rate a very similar, phenomenon attends the inflammation of the internal coat of an artery. This condition having been frequently observed to produce a spontaneous obliteration of veins, surgeons have been induced to apply caustic, ligature, pressure, and other artificial means, for the purpose of curing varicose veins; but as idiopathic tendency, as well as local injury, so frequently leads to the formation and absorption of pus, and to inseparable violent constitutional irritation, I would recommend you, gentlemen, to hesitate before you perform any operation on a varicose vein likely to produce acute inflammation in the vessel. The safest of the artificial means employed I consider to be the application of caustic; but the constitution of the patient should be well considered before even this is adopted.

The veins are less liable to be affected with earthy concretions than the arteries, but they are not unfrequently found to contain malignant growths, possibly conveyed there by absorption.

Pathology of the capillaries.—Placed, as these vessels are, intermediately, and at the same time continuously, both with the arteries and veins, it may be readily imagined that no alteration can take place in the natural flow of blood through either the arteries or veins which will not interfere with the circulation through the capillaries; and as in health they regulate the quantity of blood and nutrition distributed to every structure, any deviation from their normal state must be attended with most deleterious effects. If, for instance, there be increased flow of blood in the arteries, or a retardation in the circulation of the blood through the veins, the capillaries must necessarily be distended with blood, and a state of hypertrophy and hyperæmia be the result. For a time, these vessels may be capable of sustaining this condition without the occurrence of any serious morbid changes, particularly if the tissues which they are destined to supply be ready to receive the superabundant blood, and no other derangement may be produced than a little overgrowth of parts; but if the exciting cause of this state of hypertrophy be not subdued, whether the fault depends upon the arteries, veins, or capillaries themselves, these latter vessels will soon lose their tonicity: they will be congested and dilated, the blood itself impeded in its course, and effusions of other than the appropriate constituents will be thrown out, and the part may then be said to be inflamed. Serum is the constituent usually exuding through the coats of the capillaries under this condition, which very generally results from venous congestion, as is seen in œdema of the face, from pressure on the large veins of the neck; of the upper extremity, from pressure on the axillary vein in diseases of the axillary glands; and in ascites, from obliteration of the inferior cava. The effusion of coagulable lymph, or fibrin, which frequently takes place from hypertrophied capillaries, may perhaps be attributed to a state similar to that which occurs in the blood during its slow coagulation out of the body, namely to a subsidence of the red particles, which Mr. Gulliver has proved retards the coagulation of the liquor sanguinis, and perhaps fits it for escape through the tunics of the vessels. If, however, the inflamed state of the capillaries be protracted beyond the periods described, instead of either serum or lymph being effused, *pus* escapes, the solid particles of which resemble in some measure blood globules in form, but are nearly twice the size, and are supposed to be exudation globules converted into pus by some peculiar vital action.

Pathology of the absorbents.—Changes in the absorbents, similar to those which have been described as taking place in the arteries, veins, and capillaries, have not been observed, although there can be but little doubt that they are as prone to disease as the rest of the circulating system. The absorbent vessels seem to be more particularly affected in cases in which poisons are introduced into the system; for we find, after wounds received in dissection, inoculation of syphilitic virus, and after the bites of poisonous animals, that the absorbents are first affected, and the blood and tissues subsequently,—a sufficient evidence of the important part the absorbents play in the animal economy.

Lesions of the parietes of the lymphatics are very rare. Andral states that out of 600 examinations, he only three times found the thoracic duct reddened and injected, and in one case pus was in its walls. Depositions in the thoracic duct occur sometimes concomitantly with malignant disease of the uterus. Thickening of the walls of the thoracic duct may lead to its obliteration, in which case collateral branches will be thrown out, for the purpose of conveying the lymph from below to above the obstruction. The lymphatic branches present more morbid alterations than the ducts: this has been observed in ulceration of the bowels, when the lymphatics have been seen forming enlargements at their valves; these little agglomerations of matter were so numerous as to appear like tubercular grains scattered beneath the peritonæal coating of the intestines. A morbid change sometimes takes place in the lymph itself. Experiment has shown that long fasting will produce an effect of this kind, the lymph of the thoracic duct becoming sanguineous in character. In certain diseases the lymph seems to become mixed with some peculiar foreign matter, as in jaundice, &c. When the thoracic duct is obstructed, either from pressure or disease, the transmission of the fluid may be carried on by the greater development of other ducts; that is to say, by a kind of collateral circulation, as in the case of obstructed arteries and veins. When this occurs, the fresh branch issues below the obstruction and re-enters above. The lymphatic system is particularly active in infancy, and is consequently more liable to disease at that period of life; the disorders of this system relate to the functions of circulation, nutrition, and secretion. Calcareous deposits may occur in the lymphatic glands, as in other tissues; and indeed such depositions are not uncommon in old age, and have been found concomitant with ulceration of bone at earlier periods of life. The lymphatic glands are very subject to become diseased in individuals of strumous constitutions, and may then produce considerable interference with the functions of an organ, by mechanical pressure.

If, from any local cause, the tissues of the body are rendered incapable of receiving the normal products of the healthy blood distributed to them by healthy bloodvessels, a reaction must necessarily take place, and an altered condition of both blood and bloodvessels be the consequence; so that the nutrition of the body must evidently depend as much upon the healthy recipient power of the tissues as upon the integrity of the blood and bloodvessels themselves.

INFLAMMATION.

Having given an outline of the healthy and morbid conditions of the blood, and the vessels which circulate it, we are now prepared to enter upon the subject of inflammation, a subject of the utmost importance to the surgeon, being continually the object of his treatment, either from its local or constitutional effects. Every structure in the body furnished with bloodvessels is liable to inflammation, but its effects are modified by the peculiarity of the physical arrangements and degree of organization of each tissue, for there can be but little doubt that "surface action" as much modifies elimination from the capillaries, as the peculiar vitality of each part affected with inflammation.

So universal is inflammation, that every disease, it may be said, either begins, ends, or in some period of its progress is accompanied, by it. Such being the case, it often becomes the duty of a surgeon to modify or alleviate inflammation by local or constitutional remedies; and yet, at the same time, it is more or less essential to every restorative process. Were it not for inflammation at the very commencement of our infant existence, we should only breathe to breathe our last, in consequence of the hæmorrhage resulting from the mechanical separation of the infant from the mother. Of such importance are its salutary influences to the surgeon, that he needs it to secure the desired results of the slightest operation; without it no wound could heal, no fractured bone unite; by it abscesses are limited in their extent, foreign bodies surrounded and prevented from injuring the parts in which they are imbedded; and in ulceration of the bowels, it performs the important office of closing the orifice in the intestine, and preventing the extravasation of effusions which would speedily cause death. But inflammation has yet a further claim upon the consideration of the surgeon; he can command and modify it, and render it an instrument of cure; he employs it in all plastic operations, and even induces it for the cure of many diseases.

As inflammation, however, may arise spontaneously, and become formidable from its effects, or may be produced locally from some external agent, its causes constitute a very important part of the study of the pathologist, as by removing the cause inflammation may sometimes be at once cut short. This task, however, is frequently most difficult to accomplish, and more especially to the physician, as the diseases under his care are generally internally seated, and the symptoms obscure; while to the surgeon, whose attention is most commonly directed to external derangements, the diagnosis is comparatively easy.

The circumstances inducing inflammatory actions are divided into the *Predisposing* and *Exciting*. A very frequent predisposing cause is *Idiosyncrasy*, which, gentlemen, you may perhaps consider as hardly coming within your province as surgeons; but you will hereafter find in practice that it so frequently interferes with the treatment of disease, that in ignorance of its influence you would be baffled in all your attempts to relieve your patient. I have known persons, for instance, who, after eating some kinds of shell-fish, and even certain vegetables, have been attacked with violent inflammation of the skin, attended with great itching, and considerable constitutional irritation, consequent on an attack of urticaria, which, when appreciated, may be easily cured by a judicious change of diet and a little purgative medicine. I may now caution you against thinking lightly of the assertion of patients, that they cannot take some kinds of medicine in consequence of its producing particular effects not intended by the prescriber. This is, in fact, idiosyncrasy, and I have known it happen that two grains of calomel administered as a purgative have produced violent salivation: opium also, instead of procuring rest, will at times in some persons produce delirium.

Temperament has a great influence both on the action and effects of inflammation, modifying its symptoms, and determining the treatment to be employed. Persons of a sanguineous temperament, for instance, are more liable to acute inflammation than those of a phlegmatic constitution, as would naturally be presupposed from their greater excitability, but yet experience teaches us that these persons cannot bear the loss of blood to any great extent, for as you diminish their powers you increase their irritability. Narcotics, with sudorifics, are therefore generally indicated in the treatment of inflammation in such constitutions.

Diathesis is another predisposing cause of inflammation. Under its influence a specific inflammation, as gout, or rheumatism, is often produced in one person from exposure to an exciting cause, which, in another, would give rise to an attack of inflammation of a common character. But, of all the various diatheses, there is none which claims a greater share of a surgeon's attention than the strumous or scrofulous, not only on account of its great prevalence in this country, but also from the constitutional powers being so changed, that extensive and protracted local inflammation may take place without any other sign of its existence than swelling, unattended either with heat, pain, or redness, symptoms of such general occurrence in common inflammation. You might thus, gentlemen, mistake the true nature of the case under your treatment, unless fully conversant with this peculiarity of the diathesis in question. The mode of living and habits of your patient are also important points to be attended to, as they exert a very marked influence on the predisposition to inflammation, and modify its character when it does occur. You will have plenty of opportunities of observing this fact in the wards of the hospital, and will find how much the treatment of the patient has to be modified by the facts elicited from an inquiry into the previous mode of life. Persons, for instance, who have been exposed to bad food and clothing, but who at the same time have been habituated to the constant stimulus of porter and ardent spirits, must be treated in a very different manner under inflammation from those who are just from the country, and who have lived regularly, and been accustomed to pure air. The former will not bear lowering; if you attempt to lower them you bring on irritative fever: indeed, they generally require porter or wine with opium, to diminish their peculiar excitability. The latter must be treated upon a strict antiphlogistic plan. You will observe, therefore, that there can be no general rule laid down for the treatment of any disease, whatever may be the name you give it: you must regulate the treatment to be employed for its cure, by examining closely the constitution of your patient, making allowance for peculiarity of idiosyncrasy, ascertaining the temperament, studying the diathesis, and inquiring into his habits.

Thus informed, you have only to make choice of the remedies to be employed, which is not, you will find, so difficult a part of your study as you are now most likely disposed to believe. The simplest means to restore secretions, and allay irritation, will be generally found sufficient for the desired object, in surgical cases.

Not only intemperate living, but any cause which tends to impair the healthy balance and tone of the vascular system, must necessarily act as a predisposing cause of inflammation.

The *exciting* causes of inflammation may be divided into those which act locally or primarily, and those which act constitutionally or secondarily. Under the local or direct causes may be considered the various classes of irritants which produce their effects *mechanically,* as violent blows, wounds, or the intrusion of foreign bodies. Such causes may, however, sometimes produce their effects indirectly; as, for instance, when the absorbents and distant glands become inflamed. Punctured and poisoned wounds principally lead to these distant and indirect effects. A good illustration of the effects of a mechanical cause, is the accidental introduction of a grain of sand into the eye: violent inflammation immediately comes on, with a profuse secretion of tears, after which, if they be not successful in washing out the irritating cause, the inflammation increases, attended with great heat, swelling, and pain,—symptoms which are only to be relieved by the abstraction of the foreign body. This is no sooner effected than all the symptoms are relieved and quickly removed. There can be no better instance given than the one which I have just described, of the necessity of applying the remedy for the removal of the cause, rather than prescribing for symptoms which cannot be relieved while the exciting cause remains.

Chemical causes produce also violent local inflammation. Acids, escharotics, and perhaps I might add, burns and scalds, induce high inflammatory action, to a degree depending upon the strength and continuance of their application. These effects are attributed to chemical action, but there is some difficulty in ascertaining whether the effects produced depend wholly on chemical action.

In illustration of the *secondary* or *constitutional* effects produced by a local cause, I may allude to the effects resulting from the introduction of *poison* into the system from the bite of a snake, sting of a hornet, wasp, &c.; but whether the constitutional derangement is to be referred to the deterioration of the blood, or to the impression made upon the nervous system, is still a question *sub judice.* I confess, I believe it is through the blood, and not the nerves, that the baneful influence of the poison is primarily communicated to the affected animal. Small-pox, glanders, and syphilis, may also be considered as falling under the category of exciting causes which act generally or constitutionally on the system.

Cold, or rather I should say, the reaction following the sudden abstraction of heat, leads frequently to violent inflammation, sometimes producing mortification; such cases require great care in the application of the means to be employed for the restoration of the "frost-bitten" part; it should be rubbed with snow, and the patient kept at a low temperature, as the sudden exposure to heat is almost certain to induce sphacelus, by producing too rapid and violent a reaction.

It is useless to dwell longer on the causes of inflammation; anything which interferes with the natural functions of a part will be certain to induce more or less of an inflammatory action, either as constituting disease or salutarily restoring the disturbed equilibrium.

LECTURE III.

Phenomena of inflammation—Signs of inflammation separately considered—Pain, its importance and action during surgical operations—Circumstances modifying its character and degree—Heat, real—imaginary—Treatment—Redness, theories of its cause—Differences of; important in treatment—Swelling—Different kind of effusions—Various terminations to inflammation.

Phenomena of inflammation.—From the causes I have already described arise various phenomena to a greater or less extent inseparable from inflammation. Since the time of Celsus, "rubor, calor cum tumore, et dolore," have been considered the signs of inflammatory action—indeed, indicating *inflammation;* and although the first impression may lead you to suppose there is no just distinction to be drawn between the two terms in their common application, I think I can explain to you that there is an important one. For instance, you may find redness, heat, swelling, and pain produced by the hyperæmiated state of vessels under the existing influence of formative action, as observed by John Hunter during the annual growth of the stag's horn, and other similar conditions; but during this process the effusions from the hypertrophied capillaries are quite natural, though abundant, and in due proportion to the wants of the tissues to be supplied, unattended with any severity of symptoms or constitutional disturbance. But upon the accession of inflammation excited by any morbid change in the bloodvessels or tissues, a new set of phenomena arises. First may be observed an increased flow of blood through the vessels to the part affected, probably depending in some measure upon an active systole of the heart, and in some degree upon the tonic state of the vessels themselves. The capillaries next become distended, partly from being unequal to appropriate the quantity of the blood sent to them, and partly from the tissues being unfitted to receive the superabundant supply of nutriment, redness, and heat, resulting from this condition. Irregularity in the circulation of the blood through the capillaries next occurs; instead of flowing steadily onwards, the blood oscillates, passing on, then retrograding, and again flowing; but in a short time, separation of the red from the colourless corpuscles takes place; the larger colourless ones adhere to the inner coat of the vessels, while the red particles are circulating with considerable rapidity in a central channel formed by the peripheral adhesion of the white corpuscles. The blood next becomes stagnant, and its constituents are effused into the surrounding tissues by exosmosis from the vessels, and distention and tumefaction result. The effusions which take place may be serum, liquor sanguinis, some red particles mixed with them, or even pus; according to the degree of inflammation, the peculiarity of the constitution affected, and of the tissues inflamed.

The secondary effects produced by these different effusions on the general health of the patient, constitute the great points which enable the surgeon to regulate his treatment for their relief; for as there are peculiar symptoms pathognomonic of each effusion, although modified by particular constitutional conditions, he is enabled to ascertain whether local or general means are to be employed; or, in other words, whether his patient be labouring under constitutional or irritative fever. This subject will be more fully treated when speaking of irritation. We will now consider each of the phenomena of inflammation in a pathological point of view.

Pain is very frequently the earliest symptom which ushers in inflammation, and even first directs the patient's attention to the seat of disease. I was, some years ago, sent for to a lady about fifty-six years of age, who awoke in the middle of the night with a severe pain in the left foot, attended with some slight degree of constitutional irritation; I was surprised to find, upon examination, the absence of redness, swelling, or heat, although there was complaint of pain, of a general diffused character, over the whole foot; I felt convinced it was not gout, although to that disease the patient attributed her suffering. In a few hours, absorbent inflammation became apparent by red lines running up to the groin; the foot became suffused and red, the posterior and anterior tibial arteries beat with unusual force, vesicles arose, in a few hours the whole foot was in a state of sphacelus, and in three days the lady died.

I mention the case merely to illustrate the fact, that pain is sometimes the first symptom of inflammation, even of acute gangrene. I formed a correct diagnosis from the character of the pain, as it was dull, throbbing, continued, and diffused, and not a tearing pain at one circumscribed spot, as in gout. Thus you observe, gentlemen, that pain may assist in forming a diagnosis; for it is very various, not only in intensity but in character; it may be acute or obtuse, constant or intermittent. These varieties, of course, are only to be appreciated by the surgeon, from the description given by the patient. It is, however, to be remembered, that we cannot always rely on a patient's description; for one, adopting an extravagant style of expression, will describe as insufferable agony what another, under similar circumstances, would only speak of as a sensation of uneasiness. It is also to be borne in mind, that persons of a sanguineous temperament are doubtless much more sensitive than those of a phlegmatic constitution. Every one must have been struck with the difference of the intensity of suffering complained of by patients submitting to similar surgical operations. Still, I do not believe that those who suffer the least pass through the restorative process the best, or recover the soonest. I have seen persons undergo formidable operations, not only without expressing the usual suffering, but also declaring they felt but little pain during its performance; and I have usually found that such constitutions were slow in their recovery. I remember being present with the late Sir Astley Cooper, upon the occasion of his removing a large scirrhous breast from a lady, who, during the operation, evinced the most perfect indifference to the procedure, and upon Sir Astley's extolling her for her magnanimity, she replied, "You are giving me praise where none is due; for I assure you, Sir Astley, the operation gave me no pain whatever, not even amounting to a disagreeable sensation:" but nevertheless, in a week she was dead. Pain is as essential, depend on it, to certain conditions of the human frame, as its absence is to health. Still, however, when pain is an urgent symptom of inflammation, and inordinate in degree, a surgeon defers operating under such circumstances, as he would under aggravation of the other signs of intense inflammatory action, and first subdues its severity by leeching, fomentations, opiates, and other antiphlogistic means. No one, for instance, would think of injecting a hydrocele while the tunica vaginalis was excessively tender, or of passing a seton through, or blistering, a highly inflamed bursa, until the pain and other signs of inflammation were subdued. There may, however, be exceptions to this rule of delaying operations in consequence of the severity of pain; as, for instance, in case of a tumour, or some extraneous body, pressing on a nerve; under such circumstances, the cause must be removed, or the symptom will continue. The difference here is, that the pain is depending, not on inflammation, but on mere physical irritation—a distinction most important to appreciate.

It has been a matter of discussion amongst physiologists, whether pain be the cause or the effect of inflammation; or, in other words, whether nerves are primarily or secondarily affected. There are arguments in favour of, as well as against, both of these positions: those adduced in support of the former are, the early presence of pain on the infliction of an injury; but, inflammation does not always follow pain from this cause, nor, when it results, does it seem to be severe in proportion to the degree of suffering, therefore this opinion can hardly be tenable. The fact, of direct injury to a nerve being sometimes followed by inflammation, is brought forward as another instance of the nerve being primarily affected. A case is on record, of one of the axillary nerves being tied instead of the subclavian artery, in an operation for aneurism, and the patient died from abscess in the brain. This case, however, only proves that the nervous system may be first affected, but not that it invariably is a precursor of inflammation.

On the other hand, the facts advanced to prove that the nerves are not primarily or essentially implicated are, that cold induces inflammation without pain, and the strongest fact of all, that paralysed limbs inflame, and even with greater facility than sound limbs. I think, however, there may be some fallacy in both these adduced instances: first, that cold may, acting as a sedative, destroy the sensation of pain; and, secondly, that in paraplegia, although the patient may have lost the power of the nerves of motion and sensation, he is still subjected to the vital influence of the sympathetic system. I think there can be no doubt, that, as pain is a necessary effect of lesion, when inflammation follows injury, pain may be said to be the first symptom; but, at the same time, it is very different from that pain which arises from the effusions and swelling when inflammation is established: the former may be very properly relieved by opiates; but in the latter case, narcotics are to be avoided, as they have a tendency to check secretion and increase inflammatory action.

The kind of tissue inflamed modifies the character and degree of pain to such an extent as to form a very important aid in the diagnosis as to the particular parts inflamed. The severity of the pain seems to depend much upon the inextensibility of the structure attacked; for as the pain of inflammation is caused by the swelling of the part from effusion, pressure on nerves, and distention of bloodvessels, it must necessarily be severe in proportion to the difficulty with which the structures yield to the effusions. For this reason, the pain of a swelled testicle, and of inflammation of the eyeball, is so intolerable, while fungoid tumours superficially seated increase rapidly to great size with little or no pain: indeed, the absence of pain proves one of the principal diagnostic marks of this disease.

The character of the pain differs in various diseases: for instance, it is acute and darting in cancerous diseases, obtuse and throbbing in abscesses, and scarcely experienced in fungoid, hydatid, and chronic enlargements.

Pain in diseases of the bones is peculiar, not only from its obtuse aching character, but also from its aggravation, at night, which is attributed to the heat of the bed; but that does not explain how it happens, that at daylight a mitigation of pain succeeds, as if it put on a kind of intermittent character. In diseases of articular cartilage, particularly of the knee, there is a peculiarity as to the period of accession of pain, always complained of by those suffering from diseases of this joint,—namely, a starting, agonising pain directly they fall asleep. This, I believe, is wholly referable to the circumstance that the muscles are voluntarily exerted in keeping the joint in its easiest position while awake; and that, immediately this position ceases, by the patient falling asleep, the inflamed surfaces are pressed against each other, and the starting pain is produced.

There are many structures in the body which are said not to be susceptible of pain, and which are thought, therefore, not to be supplied with nerves: thus, for instance, healthy bone, cartilage, tendon, &c., when exposed, may be cut and torn without any sensation of pain; but, when inflamed, they become extremely sensitive, —sufficiently proving the presence of nervous filaments, which, although not, like the sentient nerves of the skin, capable of appreciating all external physical agents, are yet perfectly competent to warn each structure against any inordinate exercise of its natural function.

Generally speaking, pressure increases the sensation of pain; but this is not invariably the case, for in some instances it diminishes it; and this fact forms an excellent diagnostic mark between peritonitis and colica: in the former, the slightest pressure, even the weight of the bed-clothes, is intolerable; while in the latter, you will often see a patient leaning over the back of a chair, in order to obtain a mitigation of suffering.

Heat.—Under inflammation, the heat of a part is increased beyond the natural standard, but not above the normal degree of temperature of the blood. It sometimes happens, in local inflammation, that the patient expresses a sensation of heat in the part affected, but without any thermometrical indication of a rise in temperature, probably resulting from a morbid sensitiveness of the nerves implicated in the diseased action. But generally there is a rise in the temperature of an inflamed part, referable to the influx of blood, and, according to Liebig, the consequent rapid combustion of its tissues. The heat of the interior of the body is greater than that of the surface,—the one being within a degree of the heat of the blood, while the surface is several degrees cooler, the temperature decreasing in proportion to the distance from the heart. The extremities are invariably, in a healthy condition, cooler than the trunk. John Hunter found, that although the temperature of an inflamed part is raised beyond its natural standard, still it never rises beyond the normal heat of the blood; and therefore that the heat of a part, which from its proximity to the heart or interior of the body is naturally but a degree or two below that standard, is, under inflammation, never thermometrically increased in heat to the same extent as parts which are more distant from the heart's action. To illustrate this, he examined the rise of temperature resulting from the application of a blister on the chest, and found the thermometer indicated only a rise of about two degrees; while a blister on the extremities, which are naturally so much cooler, produced a rise of temperature of between five and six degrees. John Hunter also found the temperature of an inflamed pleura, vagina, and rectum of a dog to be but little raised; whereas, the tunica vaginalis, after being injected, had its temperature elevated from 92°, its natural standard, to 98½°; a rise of 6½°, but still not above the normal heat of the blood.

I have mentioned that patients sometimes complain of the sensation of heat in a part of the body, without any thermometrical proof of its existence. At first thought, this seems a singular phenomenon, but it is perhaps attributable to the heat evolved by the changes taking place in the tissues from an increased flow of blood to the parts, which the nerves appreciate, although the rapid evaporation from the surface prevents the thermometrical indication. Again, patients will sometimes describe a sensation of cold, and this may be real or imaginary; real, under circumstances when there is a diminution in the nutrition of the part, indicating the necessity of means to be employed to restore the circulation, such as the application of soothing fomentations, and the administration of gentle stimulants, with nutritious food. But the sensation of cold may also indicate a tendency to rigor, which is so frequently a precursor of the formation of pus. When, from local inflammation, there is a great elevation of temperature in the part affected, cold, produced by evaporating lotions, is usually recommended, and frequently its application is most grateful to the patient; but sometimes, and without any apparent cause, it will be found that cold, instead of alleviating, increases the inflammatory action, or induces a tendency to rigor: under these circumstances, fomentations should be recommended. I usually, therefore, apply tepid lotions to inflamed surfaces at a temperature of about 96°, so that there is no reaction necessary to restore the equilibrium, as must be the case when the application is either below or above the standard heat of the surface affected.

Redness. — Redness is owing to distention of the capillaries and small arteries and veins, with an undue accumulation of red corpuscles, which are either altogether stagnant or move but slowly. In the small arteries leading to the capillaries in which the red corpuscles are stagnant, the blood oscillates backwards and forwards synchronously with the action of the heart. It is to be understood that a part is not necessarily inflamed because it is preternaturally red: it may be merely in a state of congestion—a state not amounting to that arrest of the circulation of the blood through the capillaries which constitutes inflammation. Examples of this state of congestion, without actual inflammation, may be seen well illustrated in the flushed cheek of infantile remitting fever, complicated with inflammation of the ileum, and also in that wonderful phenomenon of blushing, where the redness is accompanied by a sensation of warmth, sometimes amounting to great heat, or even tingling. It has been considered that the increase of colour may depend upon the admission of the red particles of the blood into vessels which, under usual circumstances, only circulate the colourless corpuscles; but this hypothesis is not valid, for as the red corpuscles are smaller than the colourless ones, it is doubtful if there be such vessels in any structure of the body; the increase of colour is, in fact, attributable only to the admission of an increased quantity of red corpuscles, which before were so few that their colour was not appreciable to the eye.

There is much variety in the colour of the redness under inflammation, and the diagnosis as well as the prognosis may be partly formed from the tint exhibited; this is well exemplified in erysipelas. Thus, a florid red colour shows high vascular action, and unless there be some counter-influencing cause, antiphlogistic remedies are indicated.

A *purple tint* denotes venous congestion, and that the inflammation has extended to the subcutaneous cellular tissue. It frequently precedes the formation of matter and diffused abscess, indicating the necessity of support, and even stimulus.

Carbuncle offers an excellent example of the purple tint of the inflamed part, as well as of the treatment required under its presence. The peculiar copper-coloured tint, or dirty red inflammation, also forms an almost invariable diagnostic mark of syphilitic poison.

These instances afford an excellent illustration of the importance of paying attention to the changes and variety of colour, concomitant with inflammation of the surface.

Swelling is perhaps to be considered one of the most important phenomena resulting from inflammation; as its degree and kind (as far as refers to its physical conditions as well as to the constitutional symptoms concomitant with it) point out the nature of the effusion causing the swelling, and what may be the probable nature of the disease. The first cause of swelling is the mere distention of the vessels from the increased influx of blood, which may be nothing more than the result of an increased action, often disposed to terminate, without even the aid of any medical interference, in what is termed Resolution.

By Resolution is meant the spontaneous termination of inflammation by the re-establishment of the circulation in the inflamed part, without disorganisation of the affected tissues, and this should scarcely be considered as beyond active congestion. The *swelling*, however, is principally caused by effusion into the surrounding tissues either of serum or liquor sanguinis, with or without extravasation of red particles, constituting a true sign of inflammation. When serum is thrown out, the swelling is what is usually called œdematous, as indicated by a degree of coldness and paleness of the part, with an entire loss of elasticity, so that upon the application of any force the impression remains, and forms what is technically called a pitting: there is also a tendency in the serum to gravitate towards the lowest parts. This condition may depend either upon constitutional or local causes, the treatment being regulated solely by the discovery of the seat of the disease.

When the swelling is produced by the effusion of the liquor sanguinis, the centre of the inflamed part is hard and resisting, in consequence of the coagulation of the fibrin, and the circumference is œdematous from the presence of serum; the hardness often remains (sometimes permanently), even after all the signs of inflammation have subsided, either from the great difficulty of the absorption of the fibrin, or from its having become organised. When inflammation is intense, or under certain constitutional conditions, red corpuscles of the blood may be effused, in consequence of some of the over-distended vessels giving way. The effused matter forms a blastema in which new tissues, pus, &c., are developed, as the case may be.

If the inflamed structure is incapable of easy distention, and offers, therefore, much resistance, the effusion will be necessarily small, and the constitutional disturbance great. Under these circumstances early openings should be made, even without the evidence of the formation of pus; relief is afforded by this practice when even nothing but a little serum has been evacuated: in cases of inflammation of the thecæ this fact is forcibly demonstrated. When, on the other hand, the effusions take place into loose cellular tissues, it frequently affords a mitigation of all inflammatory symptoms, by relieving the distended blood-vessels.

If the effusions occur in the substance, or even on the surface of vital organs, or into the serous cavities covering them, they frequently so disturb the proper performance of the natural functions of the part as to destroy life.

The nature of these effusions constitutes a very important subject for the consideration of the surgeon, as from the constitutional symptoms they produce, they suggest the appropriate treatment for their relief.

These effusions vary according to the violence of the inflammation, the nature of the exciting cause, the kind of tissue inflamed, and, perhaps more than all, according to the peculiarity of the patient's constitution. We have instances of these varieties of effusions from constitutional causes constantly presented to us in the wards of the hospital. In persons the subjects of erysipelatous inflammation we find the effused matter, instead of being healthy coagulable lymph, to be a thin sero-purulent exudation; and the case frequently passes into one of diffused abscess. In punctured and poisonous wounds a watery serous fluid is exuded. In the healing of wounds, whether produced by constitutional or local causes, a surgeon has no better means of judging of the state of his patient's health than by observing the nature of the exudations on their surface, which likewise afford him the very best means of judging both of the constitutional and local remedies to be employed. When a serous membrane is inflamed, there is a natural tendency to the effusion of serum, from an increased action of the capillaries of this tissue, but if the inflammation be intense, fibrine becomes thrown out with the serum, and partial adhesions between the two surfaces of the serous sac are likely to occur. Such are the results of inflammation in a healthy person, but in cachectic constitutions non-organisable matter is effused, which floats as flakes in the serum, and is perfectly incapable of producing anything like adhesions. When inflammation of the serous membranes becomes very acute, it has been supposed, at least in cases of inflammation of the tunica vaginalis, that the serosity of the blood is effused, for it has been found that the fluid withdrawn from a hydrocele produced under active inflammation, did not coagulate by the application of either heat or acid. I have, however, never met with such a case, and suspect that some fallacy has arisen, from mistaking an encysted for a common hydrocele. This subject requires, however, further investigation. A continuation of inflammation, and consequent exudation of liquor sanguinis, often leads to a softening down of the tissues; the exuded matter which is infiltrated into their interstices becoming transformed into pus by the development of pus-globules. Sometimes continued inflammation induces disintegration and removal of the tissues affected, constituting what is termed ulceration. In this case the decomposed elements are thrown off in minute sloughs or absorbed. In other cases, obstruction of the bloodvessels may become so complete that the nutrition of a part is entirely stopped, and it at last dies. This is what is technically termed, passing into a state of mortification or gangrene.

LECTURE IV.

Irritability — Healthy—Morbid—Sympathy—Collapse—Irritative fever—Hints concerning phlebotomy—Dissecting-room wounds —Their treatment—Treatment of irritative fever—Treatment of the local inflammation giving rise to it—Chronic and strumous inflammation, and treatment.

On irritation—Irritative, or Symptomatic Fever.—Hitherto we have considered only the local effects of inflammation, such as are recognised by demonstrable phenomena; but I have yet to describe the effects produced on the constitution by the irritation set up by this local disturbance.

Every local injury of the periphery of the body is liable to become a source of irritation, and to affect the constitution generally. This susceptibility to receive the impression is termed *irritability.* Such persons, therefore, as are constitutionally predisposed to be affected by trivial external impressions, are said to be of an irritable, or nervous temperament. But irritability is not to be considered as always inducing a diseased action in the body; on the contrary, its baneful effects are only exceptions to the rule, while its beneficial influence is constantly exciting and supporting the most important and vital functions of the animal economy. It is through the medium of the nervous system, when duly supplied with healthy blood, that the susceptibility to stimuli is maintained in every organ in the body, and that the various functions are performed in that manner which constitutes health.

In consequence of the connexion which exists in the nervous centres among the nervous filaments dispersed through every part of the body, stimuli not only produce their effects upon those parts to which they are immediately applied, but remote organs are also influenced, and many natural functions are thus sympathetically excited—let me instance, the sympathies between the uterus and breast. We find that, soon after conception, the mammæ are excited to an active state, to prepare them for the support of the infant directly it is launched into a comparatively independent existence. Upon any foreign body irritating the glottis, the expiratory muscles are put into violent action, and the substance is expelled: the stimulus from the presence of the urine in the bladder, and of the fæces in the rectum, induces in these viscera the action necessary for the evacuation of their natural excretions.

These are a few examples of the healthy effects of irritation; but sometimes irritation is a source of unnatural sensations, and it is most useful to understand these, as they frequently assist us in forming a just diagnosis of the disease which induced them. For instance, in disease of the hip, it is not uncommon for the patient to make but little complaint of suffering in the affected joint, but to refer all his uneasiness to the knee. Those suffering from stone in the bladder, complain of pain at the extremity of the penis. From the same cause, persons who have submitted to amputation of the arm still complain of painful sensations as if of the fingers of the lost limb; the two first cases show that pain is referred by the mind to the sentient extremity of the affected nerve; and the last proves that the actual seat of sensation is not in the extremities of the nerves, but in the brain itself. Thus, when we press the ulnar nerve against the internal condyle, the little and ring fingers suffer as much inconvenience as the part on which the violence was inflicted.

These are but instances of inordinate local sensation; but *diseased action* may be ultimately produced if the source of irritation keeps up the sympathetic sensation of the distant parts, for any great length of time, inducing "an altered action by an unnatural impression," which is the definition Sir Astley Cooper has given of irritation.

We thus have morbid action being set up in a distant part exemplified by the disease of the knee, which occasionally follows the morbid sensation induced by disease of the hip. Swellings of the breast sometimes result from disordered functions of the uterus, giving a good instance of a morbid action being set up by a sympathetic influence, although it must be remembered that this may also result from a general constitutional impression, and not merely from a local sympathy. So, also, when we find the testicle becoming affected in inflammation of the urethra, it is not so much to be attributed to sympathy, to which it has been referred, as to the direct continuity of tissue and consequent extension of disease from one organ to the other.

The direct local effects produced by a continued source of irritation often offer very anomalous symptoms, and lead to considerable difficulty in discovering the source of irritation. How often is it found that ulcers in the cheek and lower jaw result from a diseased tooth, the abstraction of which cures the sore at once, even after every escharotic had failed! I have seen ulcers on the tongue which had been pronounced malignant, heal at once on the drawing of a tooth which had been the continued source of irritation, so as first to produce the sore, and, secondly, to establish it.

A banker from Cambridge consulted me a few years ago with a considerable swelling on one side of his face, attended with fœtid purulent discharge from the nose, and many of the signs of malignant disease of the antrum. I proceeded to examine the mouth, in the hope of finding a decayed tooth which might explain the nature of the injury, and the extraction of which might relieve the symptoms; although I feared there was also some constitutional defect, from the severity and nature of the symptoms. I could not find, however, any decayed tooth, nor, by striking them with a key, could I by this kind of "sounding" produce any sensation of pain in the diseased antrum. I could not, therefore, feel the propriety of ordering any particular tooth to be drawn. I observed that there was one molar tooth wanting, and I asked my patient why and when he had had that tooth drawn; to which he answered that it was a curious fact that he had never cut that tooth, yet there was a sufficient interval of space for its growth and descent. It immediately struck me that this anomaly might be the cause of all the mischief, and I recommended him at once to consult Mr. Cartwright, who, directly he looked into his mouth, said, "I have but once before seen a similar case, and have no doubt, sir, but that the deficient tooth is growing upwards into the antrum, instead of downwards in its natural direction." In accordance with this view of the case, the patient was advised immediately to submit to the extraction of the tooth, which operation Mr. Cartwright performed at once, with his wonted dexterity. In two months the patient had perfectly recovered, notwithstanding the protracted duration of the disease.

I once performed an operation on the lip of a gentleman, for the removal of a suspicious tumour, and had great difficulty in producing union in the upper part of the incision: indeed, a fistulous opening formed, and no means I could adopt produced the desired effect. Upon examination, I found one of the incisor teeth prominent, and, suspecting it might interfere with the healing of the wound, had it drawn, whereupon the wound healed directly. Now I do not mention this case merely to explain how the pressure of the tooth acted mechanically in preventing the union of the wound, but to offer the opinion as to the probability of its having produced the original disease by its constant irritation of the lip, and that the drawing of the tooth alone might possibly have obviated the necessity of the extirpation of the tumour.

A blow on the head not only produces vomiting and other sympathetic effects on important organs, interfering with the secretions generally, but it often leads to subsequent ill effects, from the inflammation caused by the injury leading to thickening and altered structure of the dura mater. The son of a medical friend of mine had a blow on the forehead, which produced immediate sickness, followed by a general derangement of the organs of digestion, which yielded but slowly to the usual medicines and strict dietetic discipline; but in about six weeks he was allowed to return to school. Shortly after, he again complained of pain in the head, giddiness, loss of appetite, and occasional nausea, when he was obliged to leave school, and return home. I was again requested to visit him. I found him pale, dejected, and complaining of a local pain on the right side of the forehead at the exact spot on which he had received the blow, attended with a listlessness, and some slight intolerance of light. On examining the part, I found it somewhat prominent and puffy. I proposed to cut down upon the bone, which was acceded to, and a small quantity of glairy fluid was evacuated. The bone looked dry, and of an ashy colour. The next day the symptoms were mitigated; in a short time the external table of the affected bone exfoliated; granulations arose from the diploe; all cerebral symptoms vanished: and in three weeks the boy was perfectly recovered. This case is the more valuable, as it shows to what extent cerebral symptoms may be present without any disease of the brain; the actual disease here being confined to the external plate of the calvaria.

Every surgeon must have witnessed the effects produced on the constitution sympathetically from a local cause; for instance, the faintness which is often produced by the passing of a bougie, even when no disease of the urethra has been detected. I therefore always, in performing this operation, take the precaution of placing my patient in a recumbent posture, first to prevent the possibility of his falling, and secondly, because he is much less liable to be seized with syncope, while lying down.

The symptoms which I have hitherto described as resulting from local irritation, have been principally referable to the impressions they have produced on the nervous system, affecting some distant part by reflex action, and without any corresponding impression on the circulating system; but there are phenomena yet to be explained, resulting from local irritation, in which the inordinate action of the heart and arteries constitutes the principal feature of the disease.

Febrile symptoms, technically termed pyrexia, very frequently follow the changes produced by local inflammation, and to distinguish it from idiopathic or primary fever, which usually results from malaria, it is termed

Irritative, symptomatic, or secondary fever.—This condition has, I have already said, been defined by Sir Astley Cooper "an altered action excited in the body by an unnatural impression." It is not, however, the severity of the impression which leads to the febrile action, for when the injury inflicted is very violent, so great indeed that nature seems incompetent to the reparation, the heart's action is diminished instead of excited, and collapse supervenes. This we find to occur from a blow upon the abdomen, producing a rupture of the intestine, or lesion of the liver, spleen, or some other important organ; and when the collapse results from such a severe cause, the patient dies without any reaction having taken place. Thus you may often judge of the nature of an injury by the immediate effects on the constitution, even when there are no external contusions or other signs of the degree of violence inflicted.

But the presence of collapse is not the certain sign of approaching dissolution, for an accident may be sufficiently severe to produce collapse for a time, from which the patient may, sooner or later, recover, and reparative action be restored. This we frequently find to be the case after severe compound fractures or lacerations into joints, or extensive burns or scalds, when in fact no vital organ is injured, but the collapse has occurred only from the sudden shock to the nervous system.

During the existence of the collapse, from either cause, it is impossible to tell the actual extent of injury sustained; in fact, to form either a correct diagnosis or prognosis. The practice to be adopted, therefore, is merely to place your patient in bed in a comfortable and equable temperature, and to wait for reaction; but should the collapse be protracted to an alarming period, gentle stimuli should be administered.

In such cases, as when collapse occurs concomitantly with compound fractures, no surgeon would think of amputating until reaction is established. As I have spoken of collapse, it becomes necessary that I should describe to you the symptoms by which you may recognise it. The patient's countenance is pale; the surface of the body cold and clammy; the pulse scarcely to be felt, and sometimes fluttering; and the patient complains of little or no pain, although his mind remains unaffected, which last circumstance forms the great distinction between collapse and the symptoms of concussion of the brain.

When reaction has taken place, or when febrile symptoms result from local injury, without any collapse having preceded it, then *irritative* or secondary fever is established, and may be recognised by the following symptoms:—The patient complains of a feeling of debility, and a sensation of chilliness, alternating with an increased heat of the skin, a quick, small, and sometimes a hard pulse, hurried respiration, thirst, loss of appetite, and a white furred tongue, headache, a general suppression of the secretions and excretions. The severity and character of these symptoms are liable to great modifications according to the age, sex, and constitution of the patient, as well as to the seat and severity of the local inflammation.

Secondary fever, as just described, is only to be distinguished from idiopathic fever by a strict investigation into the cause and history of the symptoms which first indicated a deviation from health, and which may prove sufficient to form a diagnosis; but the presence of any local source of irritation will solve the question at once. It may be very questionable whether what is termed idiopathic fever ever exists, for although the exciting cause of the constitutional disturbance may, from its situation, be very difficult to detect, it is hardly to be believed that such an action can be set up without some exciting cause. It is said—and a most important fact it is, if it be correct—that rigors more frequently mark the commencement of idiopathic fever, than fever arising from a local cause, unless from abscess. Pyrexia generally succeeds the manifestation of local symptoms, but this is not invariable, for in eruptive diseases of the skin febrile symptoms precede the manifestations of this local disease.

The degree of irritative fever arising from external injury depends as much upon certain local conditions as it does upon constitutional circumstances; as, for instance, the *mode* in which the injury was inflicted, the *extent* of the injury, and the *nature* of the tissue injured, as to its high or low degree of vitality; these are all subjects for the surgeon's consideration.

With respect to the *mode* in which the injury was inflicted, much may be judged of from the appearance of the wound—as to whether it were incised, punctured, lacerated, contused, or torn away as in gun-shot wound.

As to the *parts* injured, it is necessary to ascertain whether bones be broken, ligaments or tendons torn, joints laid open, nerves lacerated, or bloodvessels ruptured.

The *extent* of the injury is to be examined as to depth and complication of tissues injured. The *age, habits,* and *general state of health* of the injured person constitute also a most important subject for investigation.

It is only by a due consideration of all these facts that you can be enabled to judge of the best means which are to be employed, both locally and constitutionally, for the recovery of the patient; whether a limb is to be sacrificed, or whether attempts are to be made for the recovery from the injuries inflicted, without amptutation. This alternative is only to be decided by a strict examination into the constitutional powers of the patient, so that you may be enabled to draw a correct judgment as to the chances of the lesions sustained being healed, under the particular condition of the patient's restorative powers. But it is to be remembered that the severest constitutional symptoms will sometimes follow slight local injury.

The highest degree of irritation, under certain circumstances, in persons for instance of an irritable temperament, I have known follow the most trivial local injuries, as a mere puncture from a small splinter of wood, or the removal of a little tumour from the scalp. A lady consulted an eminent surgeon in this town, a few years ago, upon the subject of a small encysted tumour on the vertex of the head. The surgeon said, "Madam, I will take it out at once; the operation is perfectly free from danger;" and he at once removed it. That evening the lady was restless, and passed a sleepless night; the next morning she had rigors, erysipelas supervened, and in a week she was a corpse. No operation, gentlemen, however trivial it may be, should be performed without due preparation. The shock made upon some minds by being told of the necessity of "cutting," of "performing an operation," produces a condition unfitted to be exposed at once to such an ordeal;—avoid it, therefore; take prophylactic precautions, for even with due preparation, slight causes may produce dangerous consequences.

The following is a case of severe constitutional irritation supervening on a slight local injury:—A young woman applied to me at my house, with a ganglion on the dorsum of the foot. I tried to burst it with a blow, but could not succeed. I then blistered it, but with no better effect. I recommended her, as she complained much of inconvenience from it, to come into the hospital; and after she had been a week in this institution, that she might become accustomed to the air, diet, and habits of the place, I laid the tumor open. No ill effects followed; the wound healed, but the distention by synovia returned so soon as adhesion had again converted the secreting membrane into a closed sac. After waiting a short time, I had the foot and ankle-joint confined in splints so as to prevent any motion, and passed a single thread through the ganglion: the introduction of the seton gave no pain. A poultice of bread was ordered to be applied over the whole foot. During that night she was restless, but did not complain of pain: the next day but one I was requested to see her by my dresser. I found her with a white furred tongue, a quick and rather hard pulse, a hot skin, anxious countenance, and bowels rather costive. She complained of headache and sickness, the dorsum of the foot was inflamed, and red lines marked the course of inflamed absorbents along the inner aspect of the leg. I immediately withdrew the seton, and made a small opening in the upper part of the ganglion, which fluctuated, and ordered her a powder composed of calomel, James's powder, and opium, with effervescent saline draughts; my object being to restore secretions, and allay irritation. On that night she had slight delirium: towards the morning she perspired freely, her bowels were opened, she fell into a comfortable sleep, and upon awaking described herself as feeling "quite a different person." From that moment all her dangerous symptoms subsided, and she perfectly recovered her health, and at the same time was cured of her local complaint. Now, gentlemen, none of these symptoms are found to result from passing a seton through the skin and subcutaneous cellular tissue, although they so frequently follow their introduction through a serous sac,—offering an excellent proof of the modifications of constitutional symptoms from the kind of tissue affected, and tending therefore to the necessity of due precautions before such structures are interfered with.

Upon the first indication of constitutional disturbance, the source of irritation should be removed, and the after treatment regulated by the symptoms which may yet remain. When constitutional irritation is present, and can be traced to the existence of any exciting cause, as the intrusion of a foreign body, or the formation of pus, the surgeon at once understands that by the removal of the cause he will relieve the febrile action, and, therefore, he does not attempt to prescribe for the symptoms until he has succeeded in that object.

But it is equally important to remember that the constitution may be the principal source of the general disturbance, without any local cause: there need not exist any continued local irritation, no severity of accident, no peculiar tissue injured—there may be, in fact, nothing to be removed; but a simple wound inflicted upon a highly irritable constitution may alone be sufficient to produce all the mischief, and indeed to react upon the slight local injury.

Under these circumstances, the remedies must be first directed to the disordered state of the system, and when that has been corrected, remedies may be applied to the external lesion. We have instances of this kind arising, sometimes, from venesection: this simple operation being followed by inflammation of the wound, diffused inflammation, non-union of the incision, escape of a small quantity of pus, high constitutional irritation, inflammation along the absorbents to the axilla, rigors, pain in the axillary and pectoral regions, formation of abscesses, flushed and anxious countenance; first a white and then a brown tongue; thirst, sweats, frequently a yellow tint on the skin, delirium, and death. Upon a post-mortem examination of the injured arm, a diffused effusion of sero-purulent discharge will be found along the whole course of the injured limb, from the wound made by bleeding, to the seat of the abscess under the pectoral muscle: if the veins be laid open, they will generally be found to contain some pus globules floating in the blood; this is sometimes the case in the descending cava itself. This disease, gentlemen, is termed *phlebitis,* and is very generally believed to depend on the inoculation of some animal poison. I must say, however, I believe it to depend upon the peculiarity of the constitution at the time the patient is bled, and not upon a foul lancet, to which it is so frequently attributed. I would recommend you, gentlemen, therefore, instead of directing the whole of your attention to the cleanness of your lancet, before you bleed a patient, at any rate to study the peculiar symptoms for which bleeding may seem to be indicated. If irritability be a prominent feature, depend on it loss of blood not only will be useless, but lead to the liability of the mischief just described. Were it the poison from a lancet, how much more frequently might we expect to meet with these cases, than fortunately they occur. Rest assured, it is the constitution which is at fault, for the same symptoms are not unfrequently met with without the infliction of any wound whatever.

I should say, however, that I by no means intend to imply that you should be careless as to the use of a clean lancet, as you may produce various diseases by the inoculation of a virus, but these, I am disposed to believe, would produce very different symptoms to those I have just described.

The habits of life will alone predispose patients to constitutional irritation, and produce a very marked influence and modification of the symptoms. Only watch the patients who are admitted into the "Accident Ward" of Guy's hospital. See the brewer's drayman brought in with a fractured limb: accustomed as he has been to constant excitement from the use of porter, and ardent spirits, we never think of bleeding him, or of the employment even of any further antiphlogistic means than the mere evacuation of the bowels, increasing the action upon the skin, and indeed by securing, in the gentlest manner, a restoration of the secretions; which being achieved, opium, porter, and nourishments, may generally be safely prescribed. But in a country hospital, in agricultural districts, the treatment of a patient under the infliction of a similar accident would be very different; here bleeding is very generally required, or at any rate strict antiphlogistic means, for bleeding, now-a-days, is comparatively rarely employed; but other means are substituted just as competent to the same ends; such as tartarized antimony, purging, &c.

We, ourselves, when we first came to town from the country, with our constitutional powers vigorous, from the purity of the air we had just left, the regularity of our habits, and influence of the due discipline and fostering care of our parents, could cut our fingers in the dissecting-room with impunity, run the dissecting hooks into our flesh, and even lacerate our hands with the broken ribs, without suffering; but in the second and third winters, how cautious we became: example had warned our judgments, and the death of fellow pupils of *our own age* (I was wont to say) revealed the truth that we were not, as formerly, in vigorous health, but that our constitutional powers were diminished, although at the same time our irritability was increased; we were reduced, in fact, to that condition of health, or I might have said want of it, which renders the powers of reparation weak, and the tendency to excited and diseased action strong and formidable. A virus may in some few cases prove the exciting cause: a subject which had died of small-pox or venereal disease would doubtless affect you, but the train of symptoms would indicate the nature of the poison; unless, indeed, the mere wound induced the same train of symptoms as if no poison had been present, under which circumstances nothing could be attributed to the influence of infection.

When you have just reason to believe that you have become inoculated by virus from a diseased subject, you will be right to apply caustic or nitric acid to the part for the purpose of destroying the poison, but when you cut your finger under the usual circumstances in dissection I repudiate that plan, believing it to lead to most injurious effects, by increasing the local irritation, and consequently the liability to constitutional disturbance. Wash the wound well in tepid water, put a large poultice on immediately, carry your arm in a sling, gently open your bowels with a small quantity of calomel, James's powder, and rhubarb, followed up with saline draughts, and go at once into the country for a week, and depend on it very few of you will suffer any harm. How is it that the superintendent of our inspection-room, who sews up every body after post-mortem examination, never becomes laid up from abrasions inseparable from his occupation? were it a poison which produced the mischief, it would be impossible he could escape from its effects, for no condition of health can escape from the inoculation of a virulent poison, as of syphilis, small-pox, vaccine matter, or any virus, if conveyed into the sub-cutaneous cellular tissue.

Irritative fever, when once produced, may be very difficult to distinguish from idiopathic pyrexia, from the peculiar type or character it may assume. Thus, in cases of stricture of the urethra, attended with effusions or abscess in the perineum, an intermittent type of fever frequently supervenes, but all the bark in the world will not check the periodical paroxysms unless you discharge the offensive irritant by free incisions. Long-continued discharge from an abscess leads to hectic, while sphacelus and gangrene induce a typhoid form of fever,—more particularly when sloughing occurs in the neighbourhood of the rectum and pelvic viscera generally. Now, in considering all the varieties of exciting causes inducing secondary fever, and the modifications of the symptoms resulting from the local and constitutional peculiarities, it may be readily supposed that there are considerable difficulties in the choice of the appropriate remedies, and that no general rules can be adopted.

Treatment of secondary or symptomatic fever.—The peculiar character of the symptoms, as modified by the constitution of the patient, must be the principal indication of the remedies to be employed; for, whatever may be the local cause inducing the constitutional derangement, all the variations in the symptoms result from the general state of health of the patient. But it often happens that the local inflammation, either from the constitutional vigour of the patient, from the mildness of the attack, from the tissue affected, or the judicious topical remedies applied, subsides by what is termed resolution, without producing any secondary fever,—showing that topical as well as constitutional remedies are equally important for surgical consideration. As the exciting cause must first call attention, I shall begin with the topical treatment.

The first object must necessarily be to moderate the local inflammation, and to attempt to produce its termination in resolution; for in many cases, without the application of topical remedies, the inflammation would be sure to proceed to gangrene.

If any removable source of irritation can be detected, such as the intrusion of any foreign body, or a spicula of bone in fracture, it must be removed; if a deep-seated abscess, it must be opened, otherwise the constitution would assuredly be very soon sympathetically affected. Should no such source of irritation be detected, and still the local action go on increasing, antiphlogistic remedies should be adopted, both generally and topically, with an activity proportionable to the patient's powers. In a healthy vigorous person blood-letting is advisable generally as well as topically—generally, in a prophylactic view of diminishing the liability to sympathetic or secondary fever, and to lessen the influx of blood to the inflamed part; and topically, by leeches, to relieve the active congestion already established. This depletion must, however, be cautiously and judiciously employed, and can only be regulated safely by a due attention to the character of the inflammation, modified, as that might be, by the constitution of the patient and the nature of the tissue affected. I may be charged with having repeated this sentence tediously often, but I have done so advisedly, as I feel assured that the treatment of inflammation can only be safely regulated by attention to these facts; that is, whether the inflammation to be treated is influenced by a sanguineous temperament, producing what is termed a sthenic condition, or whether the inflammation is accompanied with typhoid or asthenic symptoms: or thirdly, if the local affection be modified by chronic or scrofulous inflammation. With these views it is clear that the treatment may be directed and applied either to the constitution or to the part immediately affected, forming what is termed constitutional or topical means of cure. I shall first speak of those symptoms which indicate the use of antiphlogistic remedies. The most powerful of any is blood-letting, which is had recourse to under the following circumstances:—First, if the peculiar temperament of the patient require it, the indication will be a strong vigorous constitution, with a sanguineous temperament, and a hard pulse, in which case the removal of a proper quantity of blood not only diminishes the force of circulation but at the same time allays nervous irritability. The effect the loss of blood has upon the nervous system is exemplified by the syncope which is produced by the removal of only a small quantity if taken from a patient in the erect posture: this phenomenon clearly demonstrating the powerful influence of the remedy, and equally, at the same time, the necessity for its cautious employment. If too much blood be withdrawn, there is danger of increasing irritability, and at the same time of diminishing the constitutional powers below the standard necessary for subsequent reparative action; hence it is, that other antiphlogistic means are now so generally preferred. It is impossible to say what is a proper quantity generally to be removed, or under what circumstances bleeding should be repeated.

Cases of inflammation of the pericardium, pleura, lungs, and peritoneum, each indicated by the hardness of the pulse, most especially demand abstraction of blood, and the continuation of pain and the hardness of the pulse indicate its repetition. But do not mistake quickness and fulness for a hard pulse, which is usually small, and sometimes in inflammation of the bowels so small as to be scarcely distinguishable, and yet requiring bleeding, which renders the pulse immediately more distinct by diminishing the tonicity of the arteries. A quick pulse rarely indicates blood-letting. The quantity of blood to be withdrawn is to be judged of by the effects which it produces while flowing, by the diminution of pain, and the decreasing hardness of the pulse. As the rapid escape of blood produces a better and more certain effect than the removal of a much larger quantity which is abstracted slowly, it should be drawn from a large opening; and it is often useful in dangerous cases to draw the blood into different vessels, so as to judge of the state of the first and last portions withdrawn. From twelve to twenty ounces is about the quantity generally abstracted to produce the desired effects. Sir Astley Cooper tried the following experiment to judge in some measure of the quantity of blood an animal could bear the loss of, before life was destroyed, to enable him to form some criterion of the largest quantity which might be abstracted from the human subject. "A dog, weighing 14 lbs., had its jugular vein opened: from this eleven ounces were discharged, when the dog fainted. The carotid artery was then divided, and from this source three ounces more were obtained, and no more could be drawn, so that one ounce of blood to one pound of solids was the portion abstracted." I do not see what deductions are to be drawn from this experiment; and, indeed, I am inclined to remark here that I believe experiments upon the lower animals will assist but little in the treatment of disease in the human subject.

When I first commenced the study of my profession in the city of Norwich, in 1810, bleeding was employed pretty nearly as the only antiphlogistic remedy to be trusted to; and, indeed, persons were periodically bled prophylactically. In that day every practitioner prided himself upon the dexterity with which he performed the operation; now, indeed, it is but rarely done, but still let me advise all to learn to perform even this minor operation skilfully. The following anecdote will show that, slight as you consider the operation, you may fail in its completion. His Majesty George IV. was taken ill, and sent for his physician, who upon examining the state of the king's health, said, "Your Majesty must immediately be bled;" to which the king replied, "I will send immediately for Mr. Philips to bleed me:" the physician said, "If it please your Majesty, I could take blood myself from you directly." "Ah!" said the king, "that is easier said than done, for Philips tells me no one can bleed me but himself." The physician persisted in the necessity for immediate phlebotomy, and the monarch consented; the vein was opened, no blood followed; a second and a third incision were made, with the same result; and then the king said, "I told you how it would be." Mr. Philips was sent for; he immediately succeeded; upon which the king turned to his physician, and said, "I am glad you did not succeed, for it would have broken Philips's heart if any one had done this for me but himself."

Topical remedies.—Leeches, cupping, poulticing, fomentations, lotions, counter-irritants, setons, issues, may any of them be necessary as topical treatment, and, indeed, such means may be required to be locally applied, even while at the same time it may be necessary to be administering bark, stimuli, and opium constitutionally: there is no incongruity in this treatment, for although depleting means may be necessary to relieve the active local congestion, still the constitution may require stimulus to excite local reparative action after the distention of the vessels has been relieved.

Purgatives and sudorifics are other antiphlogistic means employed to allay constitutional excitement, and, I think, are generally best employed together, the object being to restore all the secretions which the irritative fever has a tendency to suppress, and not to act merely on one particular secretion; for as the skin is dry, the bowels costive, the bile deficient, and the urine less abundant than natural, each of the organs concerned requires an appropriate remedy to increase its natural action, and I know of no better medicine than that which Sir Astley Cooper for years prescribed under these circumstances—

℞ Hydrargyri chloridi, gr. iij.
Pulvis opii, gr. ss. M.
Fiat pilula statim sumenda.

℞ Magnesiæ sulphatis, ℥j.
Liquor ammoniæ acetatis, ℥j.
Liquor antimonii tartratis, ʒj.
Træ. hyoscyami, ʒj.
Aquæ menthæ virid. ℥vij. M.
Capt. cochl. larg. ij. quaque 4ta horâ, donec alvus bene responderit.

These remedies will rarely fail in restoring the secretions and allaying constitutional irritation. Effervescing draughts will also be frequently found highly beneficial, particularly when there is any tendency to sickness, and antimony in that case should not be employed. Great attention should be paid to dietetic observances, and abstinence from animal food should be strictly enjoined, or, at any rate, nothing beyond weak beef-tea, or broth, should be permitted at the commencement of the excitement, and only under certain circumstances should an animal diet be allowed. Large quantities of diluents are also useful in maintaining the secretions. When inflammation is attended with symptoms of a typhoid character, general antiphlogistic means are inadmissible, as the patient is liable to become excessively reduced by any copious evacuation; yet, at the same time, it is not to be considered that such patients, however depressed, will bear animal food; for while the skin is hot, the pulse quick, and the secretions suppressed, the bowels must still be gently acted on, and small doses of opium will be found beneficial after they have been sufficiently relieved; but not until the pulse and temperature of the skin have been lowered can animal food be safely permitted.

The treatment of chronic inflammation.—Chronic inflammation is generally indicative of a scrofulous diathesis, and the treatment requires to be different from that employed in the more active inflammation. It is the constitution which is at fault; it is therefore the condition of the constitution which must be altered: hence the appropriate remedies are termed alteratives. Medicines, however, are not necessarily required: change of air, sea-side, improved diet, will often be found sufficient to produce the desired effect. In those constitutions the secreting and excreting organs are found sluggish in their action. The phenomena or symptoms arising from a strumous diathesis are ill defined, that is, they do not produce the same urgency of derangement, as in more vigorous constitutions, so the means employed to attack them must be less powerful and energetic. In chronic inflammation of joints or glands, and in the formation of indolent tumours, and even those of a specific character, as fungus and scirrhus, which go on increasing insidiously, and almost without pain, too active means prove highly injurious, and small doses of bichloride of mercury, with sarsaparilla, or Plummer's pill with hyoscyamus at night, seem to be the best remedies, assisted by generous diet and pure air. Our London Hospitals are the worst possible places for such patients to be sent to. Mercury in these cases is not given with the same view as in syphilis, to act specifically, but merely to act gently upon the chylopoietic viscera, it is given in very small doses; and as soon as the secretions are restored, should be withheld, and iodine prescribed. The formula which I usually order it in is as follows:—

℞ Iodini, gr. ss.
Potass. iodidi, ʒss.
Syrup. papav. ℥ss.
Infus. gent. co. ℥viij. M.
Capt. cochl. larga ij. bis quotidie;

With tepid applications to the chronic swellings, either warm-water dressings or the following lotion, if the warmth does not prove agreeable to the patient's feelings.

℞ Ammon. hydrochlor. ʒj.
Sp. vini rect.
Liq. ammon. acetat. aa. ℥ij.
Aquæ destillat. ℥iv. M.
Ft. lotio.

Friction, steaming, and bandaging will, each of them, in certain cases, prove advantageous, as well as a variety of stimulating applications; as, for instance, equal parts of camphor and soap liniments, with a small quantity of tincture of opium. But of topical treatment I shall have to speak more at length while describing the various local injuries and diseases to which the human frame is liable.

LECTURE V.

Resolution—Adhesion—Phenomena resulting from lesion—Effusion of blood—Effusion of lymph—Period different in different tissues—Organization of fibrine—Union by adhesion not always to be attempted—Plastic surgery—Talicotius—After treatment—Dressing wounds—Contused and lacerated wounds—Punctured wounds—Constitutional effects—Incision—Poisoned wounds.

Animal Poisons—natural—morbid.

I HAVE now finished the consideration of Irritation; and as I have shown that constitutional irritation may sometimes stop short of the accession of symptomatic fever, so I shall now have to explain that local inflammations do also sometimes terminate without producing suppuration or other disorganization of the affected tissue. I feel, therefore, inclined to draw this analogy between the two derangements, that, just as local inflammation may terminate in resolution, or go on to suppuration, ulceration, or gangrene; so may irritation terminate in resolution, or go on to irritative fever, and its consequences.

Resolution.—When local inflammation ends spontaneously, or is checked by the application of remedies, whether constitutional or topical, it is said to have terminated in Resolution, and the symptoms subside, without any disorganization of the affected structure. This may be considered, in fact, as the only true termination; for, although inflammation may lead to further effects, as adhesion, suppuration, &c., so soon as these processes have accomplished their results, the inflammation has still to subside. Resolution of inflammation is not always to be desired, and should not be sought by antiphlogistics, until a wound is healed, or a broken bone united, unless the inflammation runs too high for the accomplishment of such a result.

The process of Resolution consists in the re-establishment of the flow of blood through the vessels, which had been obstructed by the accumulated and stagnant red corpuscles. In proportion as the circulation is re-established, the exuded matter is absorbed without having undergone any but the first stages of cell-development. We thus see that as retardation, or stagnation of the blood in the capillaries, is the condition for increased exudation, so, on the contrary, a free circulation in the capillaries is the condition for the absorption of the exuded matter.

Adhesion.—None of the results of inflammation are more important than the adhesive process, by which the healing up or reunion of parts of the body recently divided is effected. The series of phenomena which follow the division of texture are not constant in their order, nor equal in their violence, as the degree of action set up depends upon many concomitant circumstances, namely, the manner in which the wound was inflicted, the texture which is severed, and the constitution of the injured person. Whatever may be the amount of these complications, effusion of blood to a greater or less extent is a certain effect of lesion, the blood soon coagulates, fills up the wound more or less, and separates the divided edges. This coagulation of the effused blood may be considered as a salutary process, as it prevents further effusion by blocking up the mouths of the divided vessels: when, therefore, there is a tendency to hæmorrhage after an operation, we should not be too diligent in sponging away the blood from the surface of the wound, but, having secured the larger vessels, should leave the coagulum sufficiently long to produce the secondary effect of permanently sealing the smaller branches. It is for this purpose that after amputations and the removal of breasts, the wounds are not dressed for three or four hours after the operation has been performed. If the coagulum be not removed,—which should never be resorted to unless it be so large as to separate the divided edges of the wound, and prevent their subsequent adhesion,—the serum and red particles are absorbed, and the approximation of the edges of the wound is promoted by the contraction of the fibrine. As a consequence of the inflammation excited by the injury, the fibrine, or coagulable lymph, is poured out, as a tenacious diffluent substance, which soon coagulates, and in a few hours becomes organized. The length of time, however, for its organization differs, from various circumstances, and most especially from the state of the patient's health.

The time which elapses before the fibrine is poured out depends upon the nature of the inflamed tissue. The capillaries of the serous membranes furnish it more quickly than those of any other structure; for, in two hours after the operation for hernia, I believe the cavity of the abdomen has been found closed from the outer wound by the effusion of lymph. Sir Everard Home found, twenty-nine hours after the operation for strangulated hernia, that this lymph had become organized, and admitted injection into its newly-formed vessels.

The process by which the organization of the exuded matter, or its conversion into new tissues, is effected, is in general altogether the same in principle as that by which the tissues are originally developed. The new tissues which are formed are cellular tissue, capillary vessels, and epidermis or epithelium. In regard to the new vessels, it is to be remarked that their development in the exuded matter is not alone the essence of organization. Organization of exuded matter into cellular tissue and epithelium may take place quite independently of the formation of blood-vessels. John Hunter was of opinion that the fibrine of the effused blood became organized; and, although this opinion is not generally admitted, I am certain I have seen injections permeate the clot of fibrine from the coagulum of blood, which originally filled up the medullary cavity of a broken bone immediately upon the infliction of the injury. The union of all clean cut wounds depends upon the process of adhesion, and was termed by Hunter, the "union by the first intention:" it is a phenomenon of the greatest importance to the surgeon, as without it no operation could possibly be performed with any hope of a successful issue.

TREATMENT OF EXCISED WOUNDS.

One of the great objects is to produce and maintain close coaptation of the edges of the wound; for, if they remain separated, union by adhesion cannot be accomplished. Sutures are therefore frequently employed, but, as a general rule, they should be avoided if the object can be obtained by more simple and less irritating means, such as plasters and bandages.

There are four different kinds of sutures employed, to which I shall call your attention. The first is the glover's stitch; it is the one in use in sewing up dead bodies, and I think but little applicable to the living subject, although I have seen it employed in harelip upon one or two occasions with great success. I should think, however, the frequent introduction of the needle, and the quantity of silk employed, likely to induce too much irritation, and liable to interfere with the adhesive process.

The quill suture is under many circumstances well adapted for the purpose of keeping the edges of a wound in good apposition. It causes no pressure immediately on the wound, and instead of inverting the cuticle, which prevents union,—as the glover's stitch is apt to do,—it tends to produce a slight eversion, and brings the parts in the best possible position for union. The interrupted suture is the one most frequently employed by surgeons, and silk is the ligature generally used, but platinum wire is preferred by some surgeons; as, however, it is rarely necessary, or right, to leave the sutures in the wound longer than forty-eight hours, I think it signifies little whether platinum wire or silk be employed. I confess I like the latter, as being more manageable. The twisted suture is principally employed in the operation for hare-lip, and in closing an unnatural opening in the urethra. It consists of the silk being twisted around a pin, passed through the two edges of the wound, which are kept in approximation by the frequent turnings of the ligature around the pin in the form of the figure 8. Although sutures are not very frequently required, they are certainly of advantage, and should be employed in cases of wounds of the abdomen, attended with a hazard of the escape of the viscera; and under those circumstances in which the edges of a wound cannot be brought into perfect contact by sticking-plaister, bandages, and appropriate position.

With regard to plaisters, the least irritating are the best, and I have never met with any so good as the adhesive plaister of Guy's Hospital, which is composed of the following ingredients:

℞ Cerat. saponis, ℥jv.
Emplast. resinæ, ℥viij.
Sesquioxid. ferri, ℥j. M.

Far better, in my opinion, than that composed of a solution of isinglass, spread on oil silk, which I have never found sufficiently adhesive to trust to, the slightest discharge loosening it. A certain degree of support is always required, although plaisters are not intended to exert a continued force in maintaining the proximity of the edges of the wound. Bandages may sometimes be employed instead of sutures, and, when efficient for the purpose, are generally preferable. Even splints may be useful when a wound is much exposed to the motion of a joint, or always in case of broken bone; which is united by precisely similar laws on the soft parts. It is also to be observed, that under circumstances where there is reason to suspect that lesion of the intestines has occurred, their action should not be excited, as this would be likely to interfere with the adhesive deposition necessary to the recovery of the patient.

Adhesion, however, is not always to be expected as the termination of lesion, as many interrupting circumstances may interfere with its completion. Ulceration, suppuration, or sloughing, may arise either from local or constitutional causes; and these should be recognised by the surgeon, as they may determine him not to attempt the union by adhesion, but rather induce him to encourage another process of cure, which, although more protracted, he has learnt from experience is more appropriate to the nature of the injury, and general condition of his patient. Persons with broken-down constitutions, from debauched habits, we know do not furnish from their blood organizable fibrine, but unhealthy effusions, and therefore we do not persist in the attempt at union by the first intention, but encourage the granulating process, by improving the general health of the patient. A precaution we should always adopt, indeed, before we submit unhealthy people to any unavoidable surgical operation; for unavoidable it must be to induce a surgeon to operate on an unhealthy patient.

But in healthy persons we look for the beneficial effects of adhesion; and, in fact, in practice rest our confidence more on this salutary action than on any other sequel of inflammation, for the checking of hæmorrhage, as well as for the union of wounds both of soft and hard structures.

Plastic surgery is so called from the operator relying wholly upon the effusion of adhesive matter, or plasma, to secure the union which he requires. Talicotius has rendered his name renowned, from his attempts, and success indeed, in removing congenital malformations, restoring traumatic disfigurements, engrafting new noses and ears, and re-establishing the integrity of damaged excretory canals. One of the most simple of such operations is that performed for the removal of the deformity of a "hare-lip," which is generally successful in its result; so much, however, cannot be said for many other plastic operations, for when a portion of skin has to be partially dissected from its natural position, to be brought down for the purpose of engrafting on a neighbouring exposed surface, you must not be disappointed if you find that the adhesion does not take place, and that your operation fails from the sloughing of the borrowed portion of integument. I have twice attempted to close an opening in the urethra by a plastic operation; one a traumatic case, and the other congenital. I failed in both, finding it totally impossible to prevent the passage of the urine through the wound during micturition, which prevented the union by adhesion. Some cases have been recorded in old works on surgery, of fingers and noses having been completely severed from the body, and, upon being accurately replaced, have become permanently reunited. From some experiments which I have made, I have reason to doubt whether a part, once completely severed from the living body, can be made to reunite. It is true that Mr. Hunter and Sir Astley Cooper transplanted teeth, and the spurs of fowls, into a cock's comb, and the legs of other birds; and that there are preparations preserved, both in the Royal College of Surgeons, and in the Museum of Guy's Hospital, which show them adherent in their new positions; but it is yet to be proved if the attachment be any thing beyond mere cohesion, independent of actual vascular connexion. Such cases, gentlemen, are to be considered rather as the curiosities in plastic surgery, and not very likely to occupy much of your attention. But in the every-day duties of your profession, you will be called upon to seek the aid of the adhesive process; it may be, in the simple healing of a trivial wound, or, it may be, in the attempt to convert the formidable accident of compound fracture into a simple one, by closing the wound by adhesion, and thus converting the injury into what John Hunter called a "compound simple fracture," in contradistinction to the "simple compound fracture" as he termed the solution of continuity of bone, which had been simple, but had become converted into a compound fracture by subsequent ulceration or abscess, producing an external wound, communicating with the fractured ends of the bone.

I have already said, it is not to be considered that every incised wound can be made to unite by the adhesive process, or that even attempts should be made to effect it. The following conditions would forbid the practice:—if too great a time has elapsed since the infliction of the wound, if its edges be inflamed, or foreign substances have penetrated the tissues, then it would be injudicious to produce coaptation, as a degree of inflammation, beyond that necessary to adhesion, is either already present, or liable to occur. Remember, however, that a certain degree of inflammation is essential to the adhesive mode of union, and yet it must not go beyond a certain extent; hence, therefore, the propriety of sometimes promoting inflammation, and, again, the probable necessity of checking and modifying it, during the reparation of an incised wound. Stimulating or soothing, and even depleting measures may be necessary, therefore, to regulate the required action.

Pain, you know, constitutes a symptom of inflammation, but it may be the mere result inseparable from the infliction of a wound. In the former case, it is unsafe to prescribe opium, as it is liable to suppress, not only the natural secretions of the body, but also the effusions necessary to reparation; in the latter case it may be administered, and we often prescribe it after painful operations, as it not only alleviates suffering, but tends to prevent the occurrence of a rigor, so frequently following severe surgical operations.

The treatment of a patient during the process of the cure of a wound, may, in a very great measure, be regulated by the appearance and actual condition of the effusions from its surface, as they form the best indications of the real state of the constitution, and enable the surgeon scientifically to choose the appropriate constitutional and local remedies: whether evaporating lotions or poultices, whether stimulating or sedative applications, are to be had recourse to; and whether antiphlogistic or tonic remedies are to be the constitutional means adopted.

You observe, therefore, how necessary it is that you should, at the same time, be conversant with the treatment of internal derangements, and with the adaptation of local adjustments, for the cure of wounds.

In the healing of wounds of all kinds, the repetition of the application of "dressings" is always necessary; and let me urge the necessity of gentleness in this procedure,—try to diminish as much as possible the sufferings of your patient; and remember that by the violent removal of plaisters, although you may save your time, you are very likely to undo nature's curative processes, and not only protract the period of your patient's recovery, but probably prevent the adhesive union, which, but for your hasty interference and roughness, was all but completed. It is said, a surgeon should possess a lady's hand, a lion's heart, and an eagle's eye; but even these gifts would avail him nothing without he possessed humanity enough to direct them.

On the dressing of "stumps" after amputations, more depends as to the well-doing of the patient than upon the amputation itself. One person cannot possibly perform this duty well; for it is required that the stump should be firmly supported during the whole period of the dressing, and the soft parts pressed forward, so as not only to prevent their retraction while the plasters are being removed, but also to assist in keeping the end of the bone well covered; not more than two strips of the plaster should be removed at once, and when the edges of the wound, thus exposed, have been thoroughly cleansed by gentle ablution, fresh straps should be applied in the place of the removed ones, and in this manner the dressing may be progressively completed, if there be no reason to give up the hopes of healing the wound by adhesion. When it is ascertained that the process of adhesion is not applicable, other means must be adopted,—such as tend to facilitate union by granulation, which process may with propriety be termed "secondary intention." When there are many wounds to be dressed upon the same person, as is so frequently the case in scalds and burns, they should not all be exposed at the same time to the irritating influence of external agents, but they should be separately dressed, by which precaution you not only save your patient much suffering, but conduce greatly to the rapidity of his cure.

Contused and lacerated wounds are not to be treated in the same manner as incised ones, for there are no hopes of union by adhesion until the injured parts have been removed, either by slough or disintegration, when lymph is thrown out upon the surface. This becoming organized, constitutes what is termed the process of granulation. One part of it is converted into cellular tissue and capillaries—granulations being composed of these new tissues in process of development;—another part is converted into pus, which serves as a covering to the under granulations.

Punctured wounds are remarkable for the degree of constitutional irritation they create; nor is there any very satisfactory explanation of the cause of this disturbance. It has been attributed to the extent of the wound being in depth, instead of in surface, so that the consequent effusions are pent up from the inextensibility of the tissues, instead of being allowed readily to escape. The greater degree of pain which is usually experienced from punctured wounds may depend also upon the larger size of the nerves which have been injured by the penetrating instrument. If such be the conditions of a punctured wound, it seems fairly indicated, that rendering it an incised one by freely laying it open, would at once relieve the patient's sufferings, by liberating the effusions. When fasciæ, thecæ, and tendons, are wounded, as they possess but little vital power, and are very inextensible, I invariably adopt this practice. In the treatment of punctured wounds, I believe there is scarcely ever sufficient attention paid to the keeping of the part injured in a perfect state of rest, the strict observance of which I have always found attended with the most beneficial effects. If the pain, redness, heat, and swelling increase, attended with absorbent inflammation and constitutional derangement, general and topical remedies must be had recourse to: the first for the purpose of allaying the fever, and increasing the constitutional powers; therefore calomel, James's powder, and opium, with ammonia and serpentary, in a state of effervescence, are indicated; while the topical means intended to subdue the local action (which is, in fact, the exciting cause of the constitutional disturbance) are poultices, fomentations, strict observance of perfect rest, and elevation of the injured limb. If such means do not relieve the local action, leeches may be required; nor is their application inconsistent with the administration of tonics at the same time. Thus we often find it necessary, particularly in strumous inflammations, as in ophthalmia and diseases of joints, to recommend even stimuli internally, while topical depletion is employed at the same moment, and with the greatest advantage. Some surgeons recommend, when absorbent inflammation exists, to paint the course of those inflamed vessels with lunar caustic; but I cannot myself understand the rationale of this treatment, unless it be intended to act merely as a counter-irritant. I confess I should be more afraid of the liability to phlebitis, than sanguine in the expectation of checking the inflammation of the absorbents; and I believe caustic should only be used where there is reason to believe that some actual poison is the irritating agent.

Poisoned wounds.—With respect to the treatment of the effects of poisons taken into the stomach, I must leave the consideration of that subject to my friend and colleague Dr. Alfred Taylor, whom, I believe, I may justly pronounce to be the first toxicologist of the age; I shall therefore only direct attention to the symptoms arising from the introduction of poisons into the system from without.

John Hunter has defined a poison as a "matter which produces a peculiar irritation, and affects the vital principle in a peculiar manner, even when given in the smallest possible quantity, and this without relation to any known chemical or mechanical powers."

From the sting of a nettle to the direful effects arising from the bite of a rabid animal, such distinct phenomena result, that medical aid is necessarily required for their relief. It is my province, however, according to conventional custom, particularly to draw your attention to animal poisons, which may be divided into two kinds—natural and morbid. "The *natural,*" says Hunter, "are such as belong originally and naturally to the animal possessing them, not depending on any preternatural affection or alteration in structure. The natural poisons have no power of propagating their effects beyond the individual affected."

"The *morbid,* on the contrary, depend on a preternatural action or change of structure in the body communicating. The morbid poison in general may be communicated by the poisoned to others, and, therefore, may be propagated to many individuals, because the poisoned receives the same powers of poisoning others as the animal possessed by which it was poisoned." The blood, in fact, becomes tainted with the poison, and the wound itself (if one results from the mode by which it was communicated) pours out effusions capable of producing the poison in another by inoculation.

"Some of the natural poisons act only locally, as those of the wasp and bee; others both locally and constitutionally, as the poison of the viper, rattlesnake, &c." It is a question, however, if the absence of the constitutional symptoms after the sting of the wasp and bee is not attributable to the weakness of the poison, rather than to any specific difference in the poison itself. Those poisons which act upon the constitution usually first produce local effects before they are absorbed, and affect the system: as, for instance, pain in the part receiving the poison, followed by red streaks and swelling of the lymphatic glands, which are preludes to rigor, convulsions, livid effusions, swelling of the whole body, and death.

In this country there are but few reptiles the bite of which produces fatal effects; but in warmer climates there are many, the poisonous virus of which proves rapidly destructive to life. The cobra de capella and the rattlesnake, I believe, are the most fatal of the kind, and in the East Indies many persons annually fall victims to their deadly venom. It is to India, therefore, that we naturally look for the best authorities upon the treatment of those cases, and, as far as I can collect, the following is the treatment adopted:—A ligature, immediately upon the bite being inflicted, is to be tied tightly above the bitten part, with a view, there can be no doubt, of checking the absorption of the poison; and, to withdraw it from the wound, a cupping-glass or suction of any kind is recommended. The patient may himself safely suck the virus from the wound with his own mouth, as the poison does not affect mucous membranes. Large doses of ammonia are given internally, and the wound is also well washed with a solution of this alkali, with a view of neutralizing the acid properties of the poisonous secretion. It is said, however, that the natives are acquainted with some indigenous vegetable productions which act as antidotes to the poison of the cobra de capella. The symptoms which follow, when the bite of these reptiles proves fatal, are rapid swelling, attended with excruciating pain of the poisoned limb: the sensorium becomes affected, stupor supervenes, powerful convulsions and delirium follow, and death closes the scene in a few hours after the infliction of the injury. After death, decomposition most rapidly takes place. Science hitherto has done nothing towards the discovery of the immediate cause of death from the inoculation of these animal poisons; nor need this difficulty produce much surprise, when we contemplate the fact of our utter ignorance of the modus operandi of the various medicines which we apply as remedial agents. For who can explain the ultimate cause of the action of ipecacuanha as an emetic, or magnesia as a purgative, although they are every hour prescribed with a perfect confidence as to the result of their administration? The bite of the viper of this country rarely proves fatal to adults, but there are many cases on record of children having fallen victims to the effects of their poison. There is scarcely a village without either a barber or midwife, who is supposed to possess an infallible specific against its baneful effects, and as almost all the bitten recover, the restoration is attributed to the efficacy of the supposed antidote; but the fact is, I believe, that the viper of this country does not inoculate a sufficient quantity of poison to destroy life, unless, from idiosyncrasy, the patient be abnormally susceptible to its impressions. If any of you should be called to a person bitten, I should recommend excision of the part, and the application of caustic, employing afterwards such means as were most likely to subdue the mental anxiety naturally arising from the alarm, and the constitutional irritation consequent upon the local injury.

Wounds from the sting of the hornet and wasp are sometimes troublesome in persons of an irritable temperament, and require soothing remedies to prevent the constitutional effects otherwise likely to occur. The best application I know of is sweet oil, and I have myself experienced its efficacy after being stung by a hornet. I found the pain was assuaged in a very short time after its application, although it had been violent; and the swelling, which was considerable, rapidly subsided. I suppose oil acts merely by protecting the inflamed part from the influence of external agents. I have heard that indigo, rubbed on the part directly a person has been stung, prevents the usual consequences of the accident; but should inflammation persist in spite of these applications, it must be resisted by the same antiphlogistic means as are adopted under common circumstances.

Wounds inflicted during dissection frequently (as I have already said, when speaking of irritative fever) produce effects which are attributed to the absorption of animal poison, but, I believe, it is but in very few instances where the severity of the symptoms may not be found to depend upon the state of the constitution of the patient at the time of the accident, and not upon the inoculation of a poison. I do not mean to deny, that in the post-mortem examination of bodies recently dead, specific poison is not sometimes imbibed, more particularly if the person has died of puerperal fever, or of acute peritoneal inflammation; for under these circumstances there does appear to be some specific virus generated, and this is indicated by very marked symptoms. The absorbents become rapidly inflamed, the limb swells, and is extremely painful, and this pain is much increased by the slightest pressure. The absorbent glands soon enlarge, violent constitutional fever sets in, rigors and delirium follow, and, if the patient lives long enough, abscesses form in the axilla under the pectoral muscles, and often in various parts of the body. The formation of these abscesses seems a favourable symptom, for on the evacuation of the pus the patients frequently recover; but when there is not power enough for suppuration to take place, the tongue soon becomes brown, typhoid symptoms supervene, attended with a hot, dry skin, and quickly followed by delirium and death. Upon examination of these cases, not only the absorbents of the injured limbs are found highly inflamed, but also the veins, in which pus is frequently detected. Under these circumstances, the patient is said to have died from phlebitis. The presence of pus in the blood is supposed in such cases to be the great cause of the violence of the symptoms; but whether this pus is to be considered as containing any specific poison, or merely as producing its baneful influence as a fluid unfitted for circulation, is a pathological question yet to be answered. In such cases, I have already given a caution with respect to antiphlogistic treatment. Medicines should be recommended which have a tendency to restore the secretions, maintain the constitutional powers, and allay irritation. But of all things I recommend, if any of you should be threatened with an attack of this nature from a wound of the finger, that you should at once withdraw from your professional avocations, get into a Margate steam-boat, and for a few shillings you may make a most salutary excursion, and save months of absence from duty. I speak of the cheapness of the remedy I have prescribed, because I myself have experienced the necessity of husbanding resources which, although liberally bestowed by parents, are often given at the expense of submitting themselves to privation.

LECTURE VI.

HYDROPHOBIA.

Idiopathic only in carnivora—Inoculable in herbivora—Inoculable in man—Symptoms of rabies in a dog—Insensibility to pain—Period of infection after bite in dog—Post-mortem examination—Inflamed mucous membrane of organs of deglutition and digestion—Period of infection in man—Symptoms in man—Preventive treatment—Caustic—Excision—Excision not right in all cases of bite by a dog—Doubts as to the specific poison of rabid animals—Query as to inoculation without abrasion—Constitutional remedies, inefficacy of—Post-mortem examination most unsatisfactory.

Of all the diseases to which the human frame is liable, there seems to me none so appalling as that produced by the bite of a rabid dog. Besides dogs, wolves, foxes, and cats, are also supposed spontaneously or idiopathically to be affected by, or to generate rabies, as if they had a peculiar idiosyncrasy rendering them liable to its development. Cattle, and even birds, are capable of being affected by the rabid poison, when inoculated by the bite of rabid carnivora, although it is believed they never generate the disease; and some doubt is even thrown upon their power of communicating it to others, although it may prove destructive to themselves. Man has never been known to communicate the disease to another. A dog affected with rabies shows certain indications of the disease which it is well to be acquainted with, that we may regulate the treatment of a person who has been bitten by a dog supposed to be rabid. Every precaution should be taken to secure the animal, and to watch his habits, that you may either prove to your patient his perfect security from contamination, or, on the other hand, while you conceal from him your suspicions, you may employ every means in your power to prevent the influence of the poison. The early signs of madness in a dog are very obscure, and it is far from an invariable symptom that he shows a horror of lapping water or other fluids, which is generally considered so essentially pathognomonic. He may be generally known by his peculiar appearance and gait, presenting, indeed, such an unnatural manner as to attract attention. He will be observed continuing his course onwards, as if he had no motive in his progression, with his head and tail hanging down, looking as it were ashamed of himself. He seems to take but little notice of anything which does not offer a hindrance to his course, but he snaps at every obstacle, and continues his way. If he raises suspicions from these appearances, and is tied up, he will become extremely restless, hardly sleeping for an instant. Perhaps obedient to his master's voice for a short time, and giving the usual signs of recognition, he will suddenly snap at him, or anything near him or even at the air. He devours his own excrement, licks up his own urine, stares suspiciously around him, and moves from place to place as far as his chain will permit. When he barks his voice is quite altered; his eyes suffused and red; his mouth covered with thick saliva; his tongue swollen and dry; his countenance most painfully distressed and anxious; his hind quarters drooping; consciousness begins to fail him; he mutters growling snarls, seems as if dying, and then starting up at some supposed object of terror bites at it, falls exhausted. Another and another paroxysm attacks him, each weaker than the other, and at last worn out, he dies. It is said that while dogs are in a state of rabies they are quite insensible to pain, and instances are given of mad dogs seizing a red-hot poker and holding it in their mouths until dreadfully burned.

Youatt says the earliest period at which he has known rabies to occur in the dog after being bitten is fourteen days, and supposes the average time to be between five and six weeks, but he has known it come on as late as seven months after inoculation. Upon a post-mortem examination of a rabid dog the mucous membrane of the mouth and fauces is found inflamed; the tongue discoloured and swollen, congested with blood, and the papillæ at the posterior part very much raised, and generally covered with straw and other indigestible matters which the animal has attempted to swallow. The stomach is also found to contain some such extraneous matters as small pieces of wood. Its mucous membrane, and that of the œsophagus and pharynx, is inflamed and studded with spots of ecchymosis. But, in fact, nothing has been ascertained to throw any light upon the pathology of this disease. The inflamed state of the mucous membrane of the stomach and organs of deglutition is considered as pathognomonic of hydrophobia, as in the same way ulceration of the coats of the stomach is indicative of poison by arsenic, even though it be injected into the veins of an animal; but it is yet a question if the inflammation in hydrophobia is not to be attributed to the secondary effect of the altered function of the nerves, and spasmodic contraction of the muscles, rather than to the primary influence of the poison. A dog, and it is supposed any other animal suffering under the symptoms which I have described, is capable of producing the disease in the human subject by inflicting a wound with his teeth; and, it is supposed, even by applying his saliva to any part of the body. I should doubt whether rabies could occur unless some abrasion of the skin had been coincident; but it is useless to dwell upon the various opinions on this subject. The period at which the symptoms occur after the inoculation of the poison in the human subject, varies from twenty days to as long a period as eighteen months: it is said Mr. Cline had a patient under his care suffering from hydrophobia, who was attacked on the three hundred and sixty-sixth day after he had been bitten. It is enough to know, that lengthened periods occur before the symptoms are noticed, and that this period has been called by scientific writers the period of incubation; so also have they given to the commencement of the symptoms the technical name of recrudescence. In man, the time which elapses between the bite and the development of the disease, is usually between thirty and forty days.

The symptoms which occur are generally in the following order: —A pain is first felt in the seat of the original wound; the cicatrix feels stiff, numb, and sometimes cold, and there is a tingling sensation in the limb. The original wound not unfrequently becomes hot and throbbing, the cicatrix opens, and discharges a sanious or ichorous effusion. The patient experiences usually at this period extreme depression of spirits, and without the expression of any positive suffering, describes a feeling of dread, and the conviction that some awful calamity will befal him: this is indicated by frequent and deep sighs, which seem to escape from him involuntarily. This mental depression seems even to haunt those who, although affected, have no suspicion or dread of hydrophobia. The peculiar symptoms of the disease now begin to develope themselves: a stiffness about the neck and throat is complained of; the patient becomes hurried and irritable in his manner; speaks of a difficulty and dread of attempting to swallow, the very thought of which produces a spasmodic paroxysm. A breath of air, the slightest noise, the agitation of fluid, bright reflections of light, as from the surface of a mirror, induce an aggravation of symptoms, his mental powers now begin to be impaired, and his condition approaches to mania, which indeed may be considered one of the chief distinctions between this disease and tetanus. Although at lucid intervals he warns the medical attendant not to approach him too closely, perhaps the next moment, in sudden rage, he may attempt to bite him, or spit at him, and then apologises for the offence he has committed; and at this advanced stage of the disorder, he not unfrequently passes his excretions involuntarily. Such symptoms soon exhaust the patient, and, worn out by the frequency of his paroxysms, he is rarely capable of sustaining the constitutional shock beyond from twenty-four to seventy hours, when he sinks under the disease.

As prevention is always better than cure, I will now speak of the plan which should be adopted when called upon to visit a person who has been bitten. If there be reason to suspect that the dog was rabid, or even when there are no means of ascertaining the actual condition of the animal, the part should be immediately excised; and, to be certain that the whole extent of the poisoned surface is removed, Mr. Hunter recommended that a probe should be inserted to the greatest depth of the tooth-impression, and the knife passed behind it, so as to remove the probe and flesh together. Sometimes, however, this may be impracticable, from the vicinity of large vessels, in which case the knife should be used as far as is safe, and lunar caustic or nitric acid applied to the rest of the surface. I believe it would be still better to apply the acid or caustic even before the knife is used; and, if the latter were injected in solution, it would be sure to penetrate to the very bottom of the wound, and, by the change of colour, form a good guide to the surgeon for the certain excision of the whole; while, at the same time, it would render abortive any of the virus that might be left in the wound, and so prevent its contaminating the blood that flowed in consequence of the operation.

If such treatment be adopted immediately after the bite, there can be but little danger of future ill effects. It is supposed by some that this operation may be beneficially performed at any period prior to that of recrudescence, as it is believed that the constitution is not generally affected until the period of incubation is completed. I should doubt, however, that much reliance is to be placed upon this view.

If a person be bitten by a dog under such circumstances that there is no reason to suspect his being in a rabid state, but if there be, on the contrary, a thorough conviction that the bite was one of retaliation on the part of the dog, I should not recommend the extirpation of the wounded part, for the performance of the operation implies the surgeon's fear of contamination, and can but impress his patient with all the horrors of impending danger. Besides, the very excision may lead to a high degree of constitutional irritation in excitable people, and incur a risk beyond what the case justified. Only yesterday, a pupil consulted me, who had been bitten by his favourite dog, but under an aggravation which rendered it a natural result; he flogged the dog, which ran under the bed, when, laying hold of him to pull him from his hiding-place that he might continue his punishment, the dog bit his fingers. In this case, as the habits of the animal remained unaltered, and as he had lived with his master two days after, manifesting his natural docility, I would not remove the bitten part, particularly as I had reason to fear, from the constitution of the patient, that I should thereby inflict a greater injury on him than he had already sustained.

In another case, a young gentleman (the present Sir W. H.) was bitten by a dog whilst walking in the street. The dog was trotting along the foot-pavement, and his skulking, peculiar appearance attracted the attention of the bystanders; as he passed the gentleman of whom I am speaking, he made a sudden snap at his leg, without being apparently at all diverted from his own course. I did not see the gentleman until the next morning, when I was first called in. I found that the dog had seized the leg by the calf, and his teeth had inflicted two deep wounds on the inside, and one on the outside of the leg. From the description I received of the appearance and manner of the dog, I thought it advisable to excise the wound immediately; first, however, I applied some strong nitric acid to the part, causing it to completely penetrate the punctures made by the teeth of the dog. I did this by means of a glass rod dipped in the acid, which I used as a probe, introducing it to the very bottom of the wound. I then cut out the flesh and rod together, so as to ensure the complete removal of the whole of the parts which could have been in contact with the virus in the saliva of the animal, who, I ought to mention, was afterwards found to have been undoubtedly in a rabid state when he inflicted the wound. The early active measures I adopted, were quite sufficient to protect my patient from any ill consequences arising from the accident, which, under other circumstances, might have had a terrible termination. Six or eight years have, however, now passed since the occurrence took place—sufficiently proving the efficacy of the means employed.

It is curious that some people have doubted the specific poison from a rabid animal, and have attributed all the symptoms which arise from the bite of a dog to the influence of the imagination of the patient, inducing a degree of madness from the impression made upon the nervous system. Others have thought that the bite of a sound dog in a state of excessive rage, as while fighting, was capable of producing the symptoms of rabies. And, indeed, there would seem to be some reason in this supposition, as there are cases on record of persons having died from the bite of a dog which itself has not died of hydrophobia. But, on the other hand, as it never happens that fighting dogs die rabid, even after lengthened conflicts, no weight can justly be attached to this supposition.

I have seen two cases of hydrophobia myself, and in both of them the most marked symptom was the intolerance to anything like undulatory motion in the air; even the motion of the water when offered them to drink seemed rather to produce the paroxysm than the effort made at deglutition.

There are various preventive medicines which have had, in their time, a high prophylactic character, but little or no reliance can be placed upon them, and certainly they should never supersede the excision of the part. The following is an account of the cases I have just mentioned, and of a third admitted into King's College Hospital under Dr. Todd.

HYDROPHOBIA TREATED WITH MORPHIA.

Edward Lynch, an Irishman, æt. 26, was admitted into Billet Ward, under Dr. Babington, on Sept. 26th, 1837.

About five weeks before admission, a dog, which he had been thrusting at with a pitchfork, sprang at him, and bit his upper lip and cheek. He immediately seized the animal and strangled it with a hay-band. The bitten part of the lip was speedily excised, but not that of the cheek. Nothing material followed till Saturday, the 23rd of September, when, after drinking two or three quarts of beer, he was taken with a fit of vomiting, and experienced great distress at the sight of some fresh meat.

On Sunday he was very unwell, but had no spasm; and in the afternoon he fell into a deep sleep, from which he was with difficulty awakened. On Monday morning spasms came on, and he became worse.

On Tuesday, at 9 A.M., he was admitted into the hospital. On admission his condition was as follows:—He had no pain anywhere, but experienced great lassitude and a sense of constriction about his throat. He took a table-spoonful of milk, but could drink no water. His voice was feeble, and resembled a loud whisper. The countenance was anxious, and he was spasmodically affected at the approach of any one, at such a time he appeared choking. Heart's action normal; pulse soft, irregular, and 60; tongue slightly coated, but moist; skin natural; his breath was of an acid odour, and every two or three minutes he was seized with violent sighing. At a quarter before 10 A.M., he had a turpentine injection administered.

At 1 P.M. Dr. Babington saw him, and ordered Ferri Sesq. Ox. ʒj.; Syr. Aurant. q. s. ut fiat bolus, to be taken every quarter of an hour. The spine to be rubbed with Tr. Lyttæ, and belladonna plaister to be afterwards applied to the stimulated part.

At half-past 2 he sank into a sleep, which lasted three quarters of an hour.

At 5 P.M., he was much prostrated, and the spasms increased. Pulse 54, irregular, and intermittent. He experienced the feeling of a ball rising in this throat. His urine, which he passed three or four times, was rather high-coloured.

At 7 P.M. he was more restless. Mouth parched; skin hot and dry; pulse 64. The boluses were divided into three parts, and after each he took about two ounces of milk, the only nutriment taken since his admission. He has great difficulty in swallowing, and is very much convulsed.

At 10 P.M. his pulse was 54, but rather fuller; he could bear no light in his room, nor any one to approach him except his wife. His voice was natural, and he had no rigidity of muscle. He was ordered Morph. Hydrochl. gr. iij. every half hour till some effect should be produced. Unguent. Lyttæ was rubbed in over his chest about the region of the diaphragm, and afterwards belladonna plaister. He soon became more quiet, and slept from eleven till three. He passed a quiet night upon the whole, crying out at intervals. At 5 A.M. Sept. 27, he felt rather sick. He asked for a cup of milk, but swallowed it with difficulty. The bowels had not been open since his admission. The morphia was repeated.

At 8 P.M. he asked for some water, swallowed about two ounces, but immediately jumped up in bed and appeared choking. The morphia was repeated.

At 10 P.M. he was very violent and delirious. Pulse 120. He wished for water, but could not swallow it. Dr. Babington ordered the Morph. Hydrochl. to be increased to four grains every half hour. He was confined to his bed with sheets.

12 P.M.—He still cries for drink, which, when taken, makes him sick. Pulse 144. The voice is thick. Breathing more laborious, and feeling of depression much increased. He displays no greater horror of fluids than of solids. Dr. Babington ordered the dose of Morph. Hydrochl. to be increased to eight grains every half hour, and a tobacco enema to be given immediately.

About two o'clock the countenance was livid, and the angles of the mouth constantly raised and lowered. He made a noise like the howl of a dog. He breathed only eight times in a minute. Pulse small, 180. Occipito-frontalis contracted. He appeared unconscious, but now and then a calm smile played upon his face, as though his ideas were of a pleasing nature. The pupils were much contracted, and inobedient to the stimulus of light. Conjunctiva injected. He twitched the bed-clothes, and pulled his neck about. From this time he gradually became worse till twenty minutes past three, when he died. Immediately after death his pupils were much dilated, and the corpse had a very cadaverous odour. A vein was opened, but did not bleed. The next morning, however, he was deluged in blood. He took altogether forty-eight grains of Hydrochlorate of Morphia.

HYDROPHOBIA TREATED WITH LEAD.

Samuel Soring, a Londoner, æt. 35, was admitted into Billet Ward, under Dr. Addison, on the 1st October, 1837. He had formerly been addicted to drinking, but not of late years. For the last three weeks he had been in a desponding mood, so much so, that he occasionally kept his bed for a day or two, though he continued his employment, which was fish selling. About three months since he had been bitten by a spaniel. The wound was trifling, did not bleed, and caused only slight pain. On the day before his admission he was very ill, and spent a restless night. His symptoms on admission were:—An anxious and dejected countenance; breathing difficult and convulsive, and this more violent after any movement, draught of air, or sight of water; pulse 80, with little power: skin natural; tongue parched; great thirst; slight pain in the head; pupils contracted; bowels not opened since yesterday morning; a sense of suffocation and tightness across the throat. At half-past 10 A.M. Dr. Addison saw him, and ordered him to be cupped over the epigastrium. The cupping caused so much excitement, that when eight ounces had been drawn, it was thought advisable to desist. Ordered also, Haust. Sennæ c. Ext. Col. c. ʒj. as an injection, and two drops of croton-oil to be taken every half hour till it operated. The enema was soon returned, with a small quantity of fæculent matter. He swallowed his medicine with great difficulty, wishing to have his eyes closed while taking it. A composition of Ext. Belladon. ʒij. and Ung. Hyd. ℥j. was rubbed on his throat. At 3 P.M. Dr. Addison again saw him. The croton-oil had acted powerfully, the stools watery and green; skin cold and wet; pupils dilated; urine scanty, and priapism present; purging still violent. Ordered Vin. Opii ʒj. statim, and Liq. Plumb. Diacet. ♏xl. every hour. The purging ceased shortly after taking the opium. At 10 P.M. Dr. Addison again saw him. After the first three doses of the lead he seemed more tranquil. He now complained of great thirst, and drank eagerly two half pints of porter. He still went on regularly with his medicine, which he was persuaded to take with great difficulty. He was constantly troubled with violent emotions, which became worse after each dose of the medicine.

At half-past 2 A.M. of the following day he was much worse. He appeared greatly distracted, imagining himself surrounded by hideous objects. It was necessary to confine him to his bed, as he would not stop there without compulsion. After this he became unconscious of everything around him. He roared in a most awful manner. The muscles of his face were horribly distorted. A large quantity of frothy saliva poured from his mouth, his lips became livid, and he appeared writhing in an excess of agony. In this state he remained till half-past four, when he became suddenly quiet, and appeared quite exhausted. Five minutes afterwards he was dead.

HYDROPHOBIA TREATED WITH PRUSSIC ACID.

Emmanuel Soult, aged 7, was admitted into King's College Hospital, under Dr. Todd, on the 22nd of November, 1841. Two months before admission he had been bitten by a mad dog under the right eyelid. The wound bled profusely, but rapidly cicatrised, and no constitutional disturbance was manifested till the day preceding his admission. He then exhibited a strangeness of manner, and slight symptoms of pyrexia only, until, a few hours after his illness had commenced, he suddenly threw himself into his mother's arms, and screamed loudly. His eyes were bright and prominent, he frothed at the mouth, and his inspiration was jerked and audible. He tossed his arms about, and tried to vomit: refused to eat, drink, or lie down, but did not object to the presence of water. At night, the symptoms were the same, but exaggerated: and on the following day, after his admission into the hospital, spasmodic twitching of the muscles of the face, neck, arms, and larynx was observed. He vomited saliva and viscid mucus. Over the chest was heard a loud muco-sonorous râle. The pulse was small, and 140. The skin was dry, but not hot. The tongue was maintained protruding from the mouth; there was also some intolerance of light. Pressure on the cicatrix of the wound did not occasion pain, nor was it red or swollen. The lower lip, at its right angle, was very tumefied, which his mother referred to his having bitten it. He evinced great sensibility to draughts of air, requesting those who spoke to him not to blow upon him.

At a quarter to 4 P.M., by Dr. Todd's order, five minims of hydrocyanic acid (Ph. L.) were placed on his tongue. At four o'clock, the spasms being frequent, and the retching violent, the acid was repeated in the same quantity, and was continued every quarter of an hour till five o'clock. After the second dose he seemed better: he was more quiet; retching less frequent; and he passed water in bed copiously, and was sensible of its escape. This state lasted till four to five o'clock, when he again, on the entrance of several persons into his room, became excited. The spasms returned with increased violence, there being at one time slight opisthotonos. The retching was more constant, and he could no longer lie down. At five o'clock, Dr. Guy, in Dr. Todd's absence, directed 20 minims of the acid to be given; and five minutes after, 10 minims more, but without any obvious effect.

At half-past five, Dr. Todd ordered another 20 minims of prussic acid. This producing little or no good, at Dr. Guy's suggestion Dr. Todd ordered a frigorific mixture to be applied to the spine and throat. This soon had the effect of alleviating all his symptoms. He became more quiet; the retching was less frequent; he did not foam so much at the mouth. The larynx and pharynx were free from spasm; but his feet getting cold, and his pulse falling, the ice-bags were removed, and hot bottles applied to his legs. He swallowed some ice, too, with greediness, after which his power of deglutition improved so much that he was enabled to take some wine and liquor opii sedativus. At seven o'clock, as he was again becoming excited, the ice was re-applied, but again removed at eight, since the heart's action was then much depressed. From this time till eleven, he was remarkably free from spasm, and his deglutition good. His tendency to delirium, however, increased, and at eleven o'clock Dr. Guy tried the cold douche. Almost immediately afterwards, the pupils, which had been previously dilated, became extremely contracted; and in a few minutes the boy was dead.

The body was examined fifteen hours after death, the autopsy revealing congestion of the brain, spinal cord, and their membranes. The cerebral substance was somewhat softer than usual. The bronchial tubes and lungs were also congested. Stomach empty and contracted; pharynx injected; its follicles being rather large.

As to the medical treatment of hydrophobia, nothing can be said to offer any rational hope of cure. All the most powerful remedies in the Pharmacopœia have proved equally ineffectual—opium, mercury, strychnia, prussic acid. Indeed, it is useless to enumerate the medicines which have been employed, as no preference can be attached to one, where all have proved useless. Bleeding and cold affusions have proved equally ineffectual. But it is not on this account that our efforts should be stayed: on the contrary, they should be exerted to the fullest extent; for, with the improvements that science is daily making, we may yet hope that some light may be thrown upon the subject, and that we may be permitted to overcome this direful disease, by the discovery of some antidote to the poison; for there is every reason to believe that rabies does not affect any particular system, but influences the whole organismus, by producing a change in the blood which unfits it for the general purpose of nutrition. Post-mortem examinations have thrown hitherto so little light upon the subject as to the cause of death in hydrophobia, that it is useless to dwell upon the various morbid appearances which have been recorded as the result of these investigations. The most general opinion, however, seems to be, that there is some change in the appearance of the nerves. In the two cases I have examined, nothing could really be demonstrated as a pathological change referable in any way to the disease. One person thought the brain and spinal marrow rather drier than usual; another, that there was a slight degree of softening of the corpora striata and thalami. In fact, ingenuity sought explanation where no tangible morbid change could account for death.

LECTURE VII.

TETANUS.

Simulating cramp — Trismus — Opisthotonos — Emprosthotonos — Pleurosthotonos—Acute and chronic—Traumatic—Idiopathic—Symptoms—Period of dissolution—Cases—Predisposing and exciting causes—Immediate cause of death—Pathology of the disease—Cases—Ether employed—General treatment.

The disease which forms the subject of this chapter is as appalling as that which occupied our attention in the last lecture, and unfortunately as incurable. I allude to Tetanus.

This disease seems to be very similar to cramp, excepting that in tetanus there is scarcely any intermission to the contraction of the muscles, while in cramp or spasm there are distinct periods of muscular relaxation.

The forms in which tetanus attacks the patient, are—trismus or lock-jaw, opisthotonos, emprosthotonos, and most rarely pleurosthotonos. In trismus, which is the most common, the levator muscles of the jaw are forcibly contracted, with pain in the temples, and an evident and permanent hardening of the temporal and masseter muscles: an uneasy sensation in the throat and neck follows, attended by great difficulty in swallowing. The countenance has an expression somewhat resembling that in hydrophobia and epilepsy, but the persistence of sensibility and intellect sufficiently distinguishes trismus from those diseases. Trismus, however, is not invariably the first symptom of Tetanus, but opisthotonos may usher in the disease; in this case, the head is drawn forcibly backwards, all the extensor muscles of the spine seem to be in a state of contraction, so that not uncommonly, in severe cases, the patient rests only upon his head and heels, the trunk forming an arch. Larrey has given it as his opinion, that when the posterior nerves of the trunk are affected, either idiopathically or in consequence of a wound, opisthotonos is the result; but when the injury is inflicted upon filaments of the anterior nerves of motion, then the body is forcibly bent forward, constituting what is termed emprosthotonos, in which case the head is sometimes drawn quite down upon the knees; in still rarer cases, the body is curved laterally, a condition which has been termed pleurosthotonos, and which would seem to depend upon the disease affecting one side of the body only; cases are recorded, however, in which tetanus was complete, and the body of the patient became universally rigid, and incapable of being bent or flexed in any direction. Larrey even states that a patient he saw under these circumstances, gave him the idea that his trunk could more easily be broken across than bent ever so slightly.

In any of these forms, there may exist so great a difference as to the extent of muscular contraction and severity of symptoms, that the disease has been divided into acute and chronic; either of which may, it is believed, arise idiopathically, or from wounds; in the latter case, it is termed traumatic tetanus.

All pathologists admit that there are predisposing as well as exciting causes which lead to tetanus; or, in other words, that there must be a condition of the constitution prone to the disease, in order that any exciting cause can induce it. The constitutions apparently most liable to tetanus, are those in which there exists a high degree of nervous irritability, and those also in which the muscular system is powerfully developed; such people are liable to become affected by tetanus from slight exciting causes, such as vicissitudes of heat and cold, indigestion, constipation, and the influence of miasmata. The effect of cold is a subject worthy of consideration, as affecting the propriety of applying cold lotions or iced water to wounds, when there is any suspicion of a tendency to tetanus. The exciting cause in traumatic tetanus is most frequently the wound of a nerve, a puncture, or tearing of tissues; gun-shot wound of a joint or fascia, treading on fragments of glass, or operations on the hand after a burn; but the fact is, that where the disposition to tetanus exists in the constitution, it is difficult to say what slight injury may not prove sufficient to produce the development of the disease; and therefore the predisposition must be looked upon as much more important than the exciting cause.

The first symptoms complained of are, a sensation of stiffness about the neck, dryness of the fauces, and some change in the voice, but these produce so little impression upon the patient's mind that he generally attributes it to having been exposed to a draught of cold air. The surgeon's fears should at once be awakened by these premonitory symptoms. He should take care, however, not to express his fears aloud, or even to question the person whether he experiences any pain in opening his mouth, as he is likely, by this inquiry, to raise the suspicions of the patient as to his being the subject of lock-jaw,—the name of which disease most persons are familiar with; and they are well aware of its frequent occurrence after injury, as well as of the danger attending it. The surgeon may arrive at his object by merely requesting the patient to show his tongue.

The next symptom, and one which follows in quick succession, is cramp. In more complete trismus, there are pain and spasm at the lower part of the sternum, evidently to be referred to morbid contractions of the diaphragm. A sensation of tightness around the chest soon supervenes. The abdominal muscles become violently contracted, and sometimes those of the limbs—all the affected muscles becoming as hard as wood, and subject to but very short periods of relaxation. The fæces and urine are retained. The patient is sleepless. If, however, a few minutes' sleep gives him relief from fatigue and anxiety, it will sometimes be found that for that period the muscles become relaxed. The mental faculties are, even to the last, scarcely ever impaired, forming, as I have said, a great distinction between tetanus and hydrophobia. The pulse is usually but little affected, nor is the skin hot or dry as in fever; speech is difficult, the appetite, however, generally remains good, so that hunger is often a symptom causing great distress to the patient, as it cannot be satiated, owing to the difficulty in swallowing. The eye becomes fixed; the alæ of the nose raised,—a natural effect of difficulty in respiration; the lips separate with the corners of the mouth turned up as if in the act of grinning, which indeed has led to the denomination "risus sardonicus:"—in fact, a more dreadful appearance than the countenance presents under these circumstances, can scarcely be imagined. These symptoms continue for some time before the action of the heart is altered, although ultimately this organ becomes affected.

The contraction of the muscles is sometimes so severe as to tear them through. Bones are said to have been broken by their action, and even the teeth have yielded to their force. Profuse sweats occasionally come on at the later periods of the disease, and constipation is generally a concomitant symptom, probably resulting from the morbid contraction of the sphincter ani.

From their severity, these symptoms, as one would suppose, soon terminate fatally; and, although it sometimes occurs that dissolution may not take place until the eighteenth day, the more common period is from the fourth to the sixth, after tetanic symptoms are developed. It is, however, said that death sometimes occurs in a much shorter period, and a case is related of a negro woman who was seized with tetanic symptoms, after slightly wounding herself with a piece of a broken dish, and died in the course of a quarter of an hour. When patients survive until the fifteenth or eighteenth day, it is in chronic cases, and in those in which the diaphragm and respiratory muscles are not affected.

A little girl, nine years of age, was lately admitted into Guy's Hospital under my care, in whom symptoms of tetanus had come on five hours before her admission, and she died within half an hour after she was placed in bed. This child had been the subject of a compound fracture of the arm about a week before, and everything appeared going on as favourably as possible till the morning of her admission, when this acute attack of tetanus occurred, and thus rapidly carried her off.

A woman was admitted also under my care, on October 14th, 1836, into the hospital, in consequence of a burn in the arm from falling into the fire in an epileptic fit. The usual applications were had recourse to, and she went on without any peculiarity of symptoms, excepting having had several fits, until the 24th, when symptoms of tetanus came on. The abdominal muscles were in this case unaffected, but the symptoms of trismus were urgent. Opium was the medicine tried, but it failed to mitigate the severity of her sufferings, and she died on the fifth day.

On June 7th, 1838, F. C. Lomas was admitted into Accident ward, under my care, with severe laceration of the leg. He had been since his birth frequently subject to epileptic fits. By the fifth day the suppurative process had set up in the wound, and he continued improving both locally and constitutionally until the 25th inst., when tetanic symptoms supervened. Calomel and opium were prescribed, with enemata of turpentine, but they proved totally ineffectual, and he died about forty hours after the attack. It is worthy of notice that in both these cases the patients had been the subjects of epilepsy.

My colleague, Mr. Morgan, admitted a patient into Petersham ward, August 4th, 1840, with symptoms of tetanus, under which he had laboured for five days. He was treated with colchicum as an internal remedy, and ointment of veratria was rubbed over the spine. Purging came on the following day to a degree requiring to be checked by aromatic confection and opium, but the effect seemed beneficial, as the patient was able to open his mouth better than he had done since his attack. The improvement, however, was but of short duration, for he died on the following day, being the seventh from the commencement of the attack.

On the 5th October, 1839, R. Stanhope, æt. forty-six, was admitted into Luke's ward with a compound dislocation of the ankle-joint, and fracture of the astragalus, a portion of which bone was removed. Violent constitutional irritation followed, for which the usual remedies were applied, but it was with difficulty subdued, and delirium was a very prominent feature in the case. By the 11th, the patient was considered in a much more favourable condition; but on that evening, tetanic symptoms came on, accompanied by considerable debility, and profuse discharge of fœtid pus. Scruple doses of quinine were prescribed, to be taken three times a day, and subsequently hydrocyanic acid was administered. Suppuration continued up to the period of death, which took place upon the third day after the tetanic symptoms had commenced.

In two of these cases, it will be observed that suppuration had taken place before the symptoms of tetanus occurred, and that in the other two it continued up to the period of death; facts contradictory of the opinion of many surgeons, that tetanus but rarely comes on as the result of wounds, after suppuration has set in.

In private practice, many years ago, I had an opportunity of witnessing symptoms of tetanus, resulting from the injection of a hydrocele. The Spanish ambassador of that day had a hydrocele injected by Sir Astley Cooper, with port-wine and water, and nothing unusual, as to his expression of pain followed the operation. On the third day, on my daily visit, I was much alarmed by the patient complaining to me of difficulty in opening his mouth, or of raising his head from his pillow, without sitting up in bed for that purpose. Sir A. Cooper being out of town, I immediately called in the late Mr. Cline and Dr. Baillie, and I remember perfectly that their prognosis was unfavourable. Calomel and opium in large doses were the medicines prescribed, with turpentine enemata, and the patient recovered, although he remained in an extreme state of debility for several weeks.

Of the particular source of irritation which induces tetanus, I think it may be said little or nothing is known. It seems, indeed, as if it occurred after every kind and state of injury, and both before and after suppuration has begun; nor is there more known with respect to the peculiar temperament, or age, which predisposes to the disease, although, perhaps it may be said, that it happens more frequently after the age of puberty. Any continued source of local irritation may be considered as likely to produce tetanus, such as the puncture of a nerve by a spicula of bone or wood, or its partial division. Hence the propriety of seeking for the source of irritation, and effecting its removal whenever it can be detected.

Cases are recorded which have been treated successfully by the complete division of a wounded nerve, and by the removal of splinters of wood.

Obstinate constipation of the bowels, or worms in the alimentary canal, have been considered by some authors as leading to tetanic symptoms, it is probably from this opinion that the use of turpentine enemata has arisen.

When all the above-described symptoms are present, it would seem that there could be but little difficulty in forming a diagnosis, but still the symptoms in hydrophobia, and poisoning by strychnia, sometimes so closely simulate those of tetanus, that, unless the history of the case has been well investigated, an erroneous opinion might be formed.

Dr. Watson, in his most excellent work on the Practice of Physic, speaks of the similarity between the symptoms of poisoning by strychnia, and those of tetanus.

The cause of death is not more explicable than that of the disease. By some it has been attributed to suffocation from spasm of the muscles of respiration generally, while others have accounted for the sudden death which so frequently occurs in tetanus by the contraction of the muscles of the glottis only.

Debility has also been looked upon as the cause of death, the disease being considered as asthenic; but from what I have experienced, it seems to me that the patient dies from excess of irritation, being "worn-out." Still death usually occurs in so short a time, that it is probable some influence is in operation through the nervous system, differing from that condition of irritation produced by protracted suffering.

But it is the pathology of this disease which is still more difficult to comprehend, and the author, in my opinion, who has thrown most light upon the subject, is Dr. Marshall Hall, with whom I perfectly agree, in considering tetanus as a disease seated in the spinal marrow, and depending upon irritation of the excito-motory system. The traumatic form of the disease is termed by Dr. Marshall Hall eccentric tetanus, in contra-distinction to the idiopathic form which he terms centric. The absence of cerebral derangement, with at the same time a high degree of irritation of the sensitive and motory nerves, seems to be a sufficient proof of the correctness of this view, and should lead, in my opinion, to such treatment as is most likely to act immediately upon the spinal marrow. I consider, therefore, that blisters, setons, opium, and purgatives promise the best effects. All we can say, in speaking of the nature of this terrible disease, is, that it appears to belong to the class of disorders traceable to nervous lesion. The most logical examination of the circumstances shows that it is the nervous system which is affected, but this is proved by physiological evidence alone,—anatomy does nothing.

About ten years ago, I admitted a patient into Luke's ward, with acute tetanus, and whose symptoms, which were of two days' standing, were very urgent. I ordered a blister to be applied to the whole length of the spine, gave him calomel and opium, and a purgative enema. The next morning, about sixteen hours after the blister had been applied, all his symptoms had subsided; he could open his mouth easily, and with feelings of exultation, I dictated to my dresser while he wrote out every detail of the case. My triumph was, however, but of short duration, for, on desiring the patient to turn in his bed that we might dress his blister, in making the necessary muscular exertion to change his position, he was seized with spasm, and died in an instant. The post-mortem examination in this case threw no light upon the subject, nor should we expect to find any distinct morbid appearances resulting from pure irritation of the spinal marrow, for this disease must be considered as rather an abnormal increase of function than a change of structure in the affected nerves, but it should not be lost sight of, that congestion, and unnatural dark colour of the cineritious part of the spinal marrow, have been frequently observed after death from tetanus.

The following interesting case was admitted into Guy's Hospital under my care, and as I tried the effects of ether to ascertain how far its vapour would prove effectual in diminishing the muscular contractions of tetanus, I have thought it advisable to bring the result of the trial before the notice of the profession.

I felt myself justified in trying this remedy (which may be, I fear, considered an experiment), as nothing has hitherto been found to alleviate the symptoms of the disease, notwithstanding the various medicines which have been employed; and I was induced to continue the use of the etheral vapour to the very last, in consequence of the comfort it appeared constantly to afford to the patient, so as to lead him frequently to ask for an inhalation.

I was also warranted in persisting in the inhalation, for, although it did not relieve the spasms to the extent I had hoped, it certainly diminished the patient's sufferings, and prolonged his life to a period considerably beyond the time to which patients usually live under an acute attack of tetanus.

June 1st.—Alfred Beck, æt. fifteen years, a strong healthy boy, of light complexion and light hair, residing in the Old Kent Road, and working at a wadding manufactory, was admitted into Cornelius ward, No. 6, having injured his hand by getting it between two cog-wheels, receiving about twenty small punctures on the palmar aspect of the hand and fingers, and some slight abrasions on their dorsal surface. One larger than the rest was situated on the back of the second phalanx of the middle finger; on the dorsum of the hand there was a semilunar wound. The edges of this wound were somewhat ragged, and the upper part of the skin was raised, forming a small flap. The edges of this wound, and that on the middle finger, were brought into apposition with adhesive plaister; the other smaller cuts were not touched, and water dressing was applied to the hand, which was covered with oiled silk, and supported on a pillow.

When I saw him, six hours after the accident, he complained of some slight pain in the hand. The skin was rather hot; pulse 96; tongue slightly furred; bowels not open since admission.

2nd.—Passed a restless night. The hand was swollen and painful; pulse 100; skin hot; tongue slightly furred, but moist; bowels not yet open; had taken no medicine.

3rd.—Passed a better night; skin cooler; pulse 80; bowels well opened in the morning; suppuration had commenced.

5th.—Complains of no pain; appetite good; bowels open; sleeps well; wound suppurating and granulating healthily.

7th.—Going on well; hand easy: got up to-day.

9th.—Says he feels quite well. The small wounds on the palmar surface of the hand and fingers are quite healed, but the larger ones on the back are granulating, and discharging a good deal of dirty yellowish pus.

10th.—The fingers being slightly bent, were straightened by means of small splints, and the whole hand supported by a larger one.

11th.- This afternoon he complained of a slight stiffness in the back of the neck, but in other respects appeared quite well.

12th.—10 o'clock, A.M.—The boy complains of pain in the back of the neck, extending down the back. The sterno-mastoid muscles are contracted, and the mouth can only be about half way opened, and when opened, the tetanic grin is observed. The abdominal muscles are contracted; the pulse 126, jerking, and slightly irregular. At 11 o'clock, A.M., the abdominal muscles were relaxed and those of the back of the neck somewhat contracted, the head being bent slightly backwards. Mr. Stocker saw him, and ordered the extract of belladonna, $\frac{1}{6}$ gr. every four hours, and a turpentine enema to be administered immediately, which, however, brought away no feculent matter.

8 o'clock, P.M.—He can now only very slightly open his mouth. The abdomen is hard, and the sterno-mastoid muscles contracted. He complains of the pain in the back being increased since the morning. The pulse is 74, full, soft, and regular; face flushed; pupils slightly dilated. He has taken four of the belladonna pills, two at intervals of four hours, and two together.

13th.—10, A.M.—I saw him in the morning, and ordered the belladonna (of which he had taken two doses of gr. $\frac{1}{6}$, and four of gr. $\frac{1}{3}$) to be discontinued, and the vapour of ether to be administered per rectum, which was done by placing some in a bladder, which had a pipe attached to it, and surrounding it with hot flannels. Just before the administration of the ether, the pulse was 86, but as soon as the patient was disturbed, it rose to 136, but during the time the ether was being used, it sank to 88, and was slightly irregular, and rather feeble.

The boy moaned at times, but seemed in no pain. The ether did not appear to produce any effect on the abdominal muscles, those of the jaw, or the sterno-mastoids, which were the only ones contracted. The corrugatores superciliorum, indeed, which were slightly contracted, relaxed, but this was probably voluntary. About ʒiij. of the ether were given. It could be distinctly detected in the breath whilst it was being used. A blister was also applied in the dorsal region of the spine, and ʒvj. of castor oil given.

8 o'clock, P.M.—He now seems pretty comfortable. The bowels have been freely opened since the ether was first used; pulse 68, soft; skin warm and moist. The ether has been twice used since the morning.

14th.—11 o'clock, A.M.—He passed a restless night, but slept at intervals for about three hours towards morning. The ether was from this period inhaled, and whilst taking it the pulse fell from 100 to 88, and became rather feeble; the boy seemed distressed, and the feet got somewhat cold. The mouth could now be but very slightly opened. He had two copious motions this morning.

2 o'clock, P.M.—I saw him, and ordered ℥ij. of port-wine, beef-tea, and eggs, to be given, the ether to be continued every four hours, and the blistered surface to be dressed with the savine ointment. The ether has no very marked effect, but still appears to afford him relief. The wound is suppurating, and healthily granulating at the edges; in the middle a small slough has formed, which seems to be tendon, it is firmly fixed, and will not come away.

June 15th.—He had several spasms during the night, some of them rather violent: they occurred at intervals of from six to twenty minutes. The ether was administered every four hours, and always relieved the spasms. The skin was warm and moist; pulse 88, soft; the extreme tip of the tongue only can be protruded. The pupils, which yesterday were rather dilated, have now quite recovered from the effects of the belladonna.

8, P.M.—The spasms are now occurring at short intervals, and do not seem to be so much relieved by the ether, which was used an hour ago. The abdomen is hard; pulse 120, full; skin warm. He has taken a good deal of beef-tea, four eggs, and ℥vj. of wine to-day.

16th.—10, A.M.—He passed a very bad night, and had several very violent spasms. The ether was administered at short intervals through the night. The mouth can now be hardly opened. Pulse 126; skin warm and moist.

8, P.M.—Much in the same state. Appears to be a good deal relieved by the ether, but has had several spasms. He passes his water without difficulty: urine acid, unaffected by heat, or nitric acid; and, on standing for some hours, deposits a small quantity of lithate of ammonia.

17th.—10, A.M.—He had several severe spasms during the night. At twelve o'clock, ʒj. of tincture of opium was given to him, which, with the ether, appeared to afford some relief. At half-past one he had ʒss. of tincture of opium, and, after this, slept for about an hour and a half. He inhaled the ether every half hour or twenty minutes, for a few minutes at a time, and dozed during the intervals. A sponge kept constantly wet with ether, was applied to the nose. During the night he was able to open his mouth far enough to protrude a considerable part of the tongue, when spasm of the muscles came on, and it was with great difficulty released from between the teeth, but not before it was severely bitten. The pupils were contracted: pulse 140, weak: bowels not open.

8, P.M.—He had two very violent spasms, one at eleven, the other at one o'clock, during which the face became much congested, the breathing laborious, and the heart's action feeble, artificial respiration was obliged to be resorted to. Had a castor-oil enema at five o'clock, which returned without any fæces. The breathing is now spasmodic; pulse 130, weak.

18th.—10, A.M.—The use of the ether was continued during the night. He had no distinct sleep. The slight spasms were very frequent, and he had one or two severe ones, during the continuance of which, artificial respiration was employed. The pulse is now 140, weak; mouth almost closed. He perspires a good deal, and is frequently taking the ether.

12 o'clock.—He had a very violent spasm at eleven o'clock, and after that, the body was drawn to the left side, and the foot of the left leg was extended and inverted. The pulse was, if anything, more weak and rapid; the pupils normal; the breathing spasmodic.

4, P.M.—Since the spasm at eleven o'clock, the body has become gradually more twisted to the left side, the opisthotonos getting very indistinct. A castor-oil injection was given him, but it returned without feculent matter: indeed, the bowels have not been relieved since Monday morning. The breathing has become gradually more spasmodic, and at every second inspiration, the left sterno-hyoid muscle is visibly contracted.

At three o'clock he had a very severe spasm, from which he never rallied, artificial respiration now failing, the pulse becoming gradually weaker, and the extremities colder. At last, the heart could be felt beating only at about 40 per minute. In a little time, respiration appeared arrested, the contracted muscles relaxed, and life became extinct. The face quickly assumed a leaden colour after death, and, in the act of dying, the contents of the rectum were discharged. The wound on the dorsum of the hand continued to suppurate and granulate healthily up to the time of death; the small slough in the centre did not come away.

Examination of the body, 21 hours after death.—The extremities were rigid. The cuticle in the dorsal region had been removed by the blister.

The examination was commenced by making an incision along the whole length of the spine down to the laminæ of the vertebræ. The muscles in the lumbar region were observed to be of a darker colour than those in the dorsal. On removing the laminæ, the veins within the canal were seen much congested with fluid blood. On opening the theca, a considerable quantity of cerebro-spinal fluid escaped, some of which was preserved for examination. The cord was found to be softer in the dorsal than in the cervical region, and the grey matter was much darker than natural.

Head.—When the calvaria and dura mater were removed, several glandulæ Pacchionii were observed. The veins on the surface of the brain were much congested. The grey matter was darker than usual. The fluid in the ventricles was slightly opaque. On removing the brain from the base of the skull, the odour of ether was very distinct. There was a good deal of fluid blood in the arteries at the base of the brain. The grey matter of the medulla oblongata was of the same colour as that of the surface of the brain. The cerebro-spinal fluid, which when taken from the theca was perfectly clear, was rendered decidedly more opaque than usual by the application of heat.

Chest.—The lungs were a good deal congested, but were not emphysematous.

Heart.—There was some ecchymosis on the posterior part of the left auricle and ventricle at their junction. There were soft clots in all the cavities of the heart, and much fluid blood in the pulmonary artery. The mitral valve was somewhat contracted.

Abdomen.—The liver was congested; the bladder much contracted. There was a considerable quantity of feculent matter in the cæcum, and several hard scybalous masses in the colon. In other respects, the viscera were healthy.

Hand.—On dissecting the cutaneous branch of the musculo-spiral nerve, a twig was traced into the wound. It was bulbous at the divided extremity, and congested. No twigs from the ulnar nerve could be traced into the injured part.

Wm. Marshall, æt. 11, was admitted into Guy's Hospital on the 14th of April, 1849, having just received a severe injury to his left leg, from the wheels of a luggage-train crushing it against some brickwork. The lower third of the inner side of the tibia was laid bare, exposing a considerable portion of the saphena major vein. The posterior tibial artery and venæ comites were lacerated, and the posterior tibial nerve exposed; the inner side of the foot was also much lacerated. There was but very slight bleeding at the time of his admission, and he was in a state of extreme collapse; the surface of his body cold, and the pulse 120. Julep. ammoniæ was administered, and reaction soon came on. A consultation was held on the propriety of attempting to save the limb, which was decided on. The wounded artery, which now began to bleed, was tied at its proximal extremity, and the soft parts brought together by sutures and strapping, and a splint with a foot-piece applied to keep the injured limb quite steady.

15th.—He had recovered from the shock and slept during the night, and he complained of very little pain. Pulse 130; bowels costive; aperient pills and saline draughts ordered.

16th.—Sutures were removed, as the wound presented a sloughing appearance, and he complains of pain in it. Bowels open; pulse 120; skin moist; eight drops of tincture of hyoscyamus ordered to each dose of his saline mixture. From this period he went on much the same, the bowels every now and then becoming irritable, requiring astringent medicines; pulse very rapid, being rarely under 120, but he was always disposed to take a sufficient quantity of nourishment until the 25th, when a considerable change was observed. His anxiety of countenance was much increased; pulse 130; great thirst; and his bowels still very irritable. He now began to refuse his porter and wine, which he had hitherto enjoyed. Aromatic confection, with opium and camphor mixture, were ordered, and a narcotic draught at bed-time.

On the 26th, while I was paying my usual visit, I observed some twitching in the injured limb and muscles of the face, and that he had become extremely restless. Pulse 136, skin dry; respiration hurried, but he was able to open his mouth to the natural extent. I suspected tetanic symptoms were coming on; a large dose of opium was ordered, and I requested my dresser to send for me directly tetanus distinctly showed itself, as I had determined to amputate the limb as soon as there was sufficient evidence of that disease; on the 27th these symptoms became decided. He had had a restless night; the angles of the mouth and alæ of the nose were drawn up, attended with a general rigidity of the facial muscles; the mouth was with difficulty opened to its natural extent, but he was capable of taking his food. At 11 o'clock, tetanic symptoms much increased; his mouth quite closed. I was sent for, and consulted with Dr. Barlow, who was in the ward, as to the state of his chest, to ascertain whether the difficulty of his breathing depended on the tetanic condition of his respiratory muscles, or on any organic lesion of the lungs; when he decided there was nothing to indicate the latter, and I proceeded at once to remove the limb. Very little blood was lost during the operation, neither was there any subsequent bleeding.

On the 28th all tetanic symptoms had disappeared, and his face had resumed its natural appearance; the mouth could be freely opened, and he had become much less irritable; pulse 124, skin warm and moist.

29th.—Has had a good night, and is in every respect considerably better; the stump does not give him any pain excepting on dressing it; reparative action does not appear to have commenced. Bowels regular, pulse 120, firm and regular. Wine, porter, beef-tea, and eggs, were ordered.

30th.—He continues to improve, his aspect natural, and everything seems favourable, with the exception of the appearance of the stump, which has made no advancement towards union.

On the 1st of May he complained of having passed a sleepless night; his respiration has again become hurried; there is also a redness of the left knee, and a slight swelling of the right foot, which is very painful on pressure, and has again become irritable. Pulse 135, skin dry, bowels relaxed, urine passed freely; no sign of tetanic symptoms, but phlebitis is dreaded; half a grain of calomel and half a grain of opium were ordered to be taken every six hours.

From this period up to the 11th of May, all these symptoms continued to increase. The swelling of his right limb continued, both knees became red, swollen, and painful, and he was extremely weak and irritable. The swelling soon extended to the abdomen, his breathing became more and more difficult, and upon auscultation a roughness was perceptible in the respiration, with a dulness over the lower lobe of the right lung. His appetite failed him, he scarcely got any sleep, and daily became worse and worse until the 11th, when he died, but without a single symptom of tetanus after the amputation of the limb.

Autopsy, 19 *hours after death.*—Œdema of the right foot and ankle and left thigh was very evident, and the parietes of the abdomen were also œdematous.

In the *Chest,* there was evidence of recent pleurisy on the left side, with inflammatory effusion, and on the right side patches of ecchymosis on the surface of the pleuræ, but no effusion. There was lobular pneumonia, with suppurative points, occurring in patches, and exhibiting the ordinary appearance of purulent depôts. There was also an abnormal quantity of clear fluid in the pericardium.

Liver pale but healthy. The whole of the mucous membrane, from the tongue to the œsophagus, was in a sloughy state, of a dirty brown colour and offensive odour. There was also sloughing of the cellular membrane and muscles of the right side of the abdomen.

The external and internal iliac veins of the right side were found to be in a sloughy state, but pervious, and filled with decomposed blood. Left iliac free and normal, but the left femoral was obstructed to the extent of three inches, and in a sloughing condition. Pus was found in the left knee-joint and in the right shoulder-joint. The axillary vein on the right side also showed signs of inflammation.

Notwithstanding the fatal result of this case, there seems just reason to consider that the tetanic symptoms were at once put a stop to by the removal of the source of irritation; it is clear that the patient fell a victim to phlebitis; and it is probable, from the nature of the injury, as well as from the history of the case, that had the limb been amputated primarily he would have had a better chance of recovery.

The lower animals seem as subject to tetanus as man. Horses are frequently attacked after the operation of docking, or from the accidental pricking of the foot in shoeing; and various experiments have been tried at the Veterinary College upon the efficacy of the numerous remedies recommended in this disease, but without any happier results than have attended the investigation of cases in the human subject. Mr. Morgan, in his Lectures on Tetanus, recommends the inoculation of the wourara poison, with a view of producing a perfect relaxation of the muscles, advising, at the same time, that an apparatus should be at hand to keep up respiration artificially, if occasion should require. Such treatment may be worth a trial; but I believe there are but few surgeons who would have sufficient moral courage to recommend the experiment.

Professor Sewell produced tetanic symptoms in an ass by poisoning him with strychnia; and, having thus caused symptoms at any rate very much simulating tetanus, he introduced the wourara poison, which in one case seemed as if it had killed the animal; but, by artificial respiration, it was restored, and ultimately recovered.

If there be any truth in homœopathy, strychnia and such like remedies are indicated; but if the principle of "contraria contrariis curantur" is to be adopted, then wourara, opium, and similar drugs, should be prescribed. But I believe counter-irritation in the course of the spine is the means which will prove ultimately efficacious, if any remedy succeeds.

I shall say no more upon medicinal treatment: all the most powerful remedies of the pharmacopœia have been found equally inefficacious. No one remedy can with confidence be recommended in preference to another, although mercury, digitalis, tobacco, musk, oil of turpentine, opium, and various other medicines, have been most carefully tried. Surgery, I fear, has done as little for the cure of this disease as physic, although there are recorded cases of persons having recovered where the amputation of limbs has been performed after tetanic symptoms had commenced, and where they have yielded upon the division of wounded nerves; but still, these operations have so frequently failed, that, had a true statistical account been kept, I suspect but little more could be said for surgical than for medical treatment, when once the disease is developed in an acute form.

So little light has as yet been thrown upon the true nature of the disease, that the medical practitioner is without the least guide to direct him in his practice. Tetanus, like hydrophobia, has hitherto defied the efforts of the physician, and our chief hope must be that future investigation, and the assistance, perhaps, of chemistry, and the microscope, will render us better acquainted with the changes that take place either in the blood or other fluids of the body, or in the tissues themselves. All that we can say at the present time is, that we know what to avoid prophylactically: that after severe wounds or amputation a patient ought not to be exposed to sudden changes of temperature; that he should be kept as much as possible from cold, damp, and violent motion; that the dressings of wounds should be soft, pliable, and not too frequently renewed; that spiculæ of bone or other foreign matter should be removed from a wound,—indeed, that every precaution should be taken to prevent that local irritation which may be likely to tend to general nervous excitement. In addition to this, it ought not to be forgotten that indigestion, worms in the intestinal canal, or determination of blood to the head, may produce that constitutional disposition, in which the most trifling exciting cause may bring on an attack of tetanus.

LECTURE VIII.

Gun-shot wounds—Difference between gun-shot and other wounds—Nature of the wound—Circumstances connected with the velocity of the impinging body—Danger to life—" Gun-shot" wound not to be considered a generic term—Difference in the process of healing of gun-shot and incised wounds—Gun-shot wounds—Simple or compound—Blow from a shot without external lesion—All wounds may be considered as either incised or contused.

Treatment of simple gun-shot wound—Symptoms regulate the practice to be adopted—Case—Eccentric course of balls—Balls remain in the body without inconvenience for a great length of time—Case—Compound gun-shot wounds—When limb is to be sacrificed and when saved—Case—When arteries are shot through but little tendency to bleed—Why—Penetrating wounds of cavities—Bleeding, indication of injury to lungs—Treatment—Bleeding.

Wounds of the abdomen—Difficult diagnosis—Contusion of parietes—Wind of ball—Penetrating wound of abdomen—Case—Protruding intestine—Wounded intestine—Case—Lesion of intestine without wound of parietes.

Gun-shot wounds differ from others only in the complete destruction of the parts which are struck, and resemble, in fact, severe lacerated and contused wounds from any other cause. They require to be treated, therefore, in a similar manner to ordinary contused wounds.

A gun-shot wound varies as to the amount of injury inflicted, in proportion to the magnitude of the missile, the velocity with which it is propelled, and upon the concentration of the force destroying the vitality of the part upon which the blow falls; while the danger to life depends upon the importance of the part injured, and upon the extent of the wound.

John Hunter has most judiciously said, that the three following considerations are connected with the velocity of the impinging body. 1st. " The greater the velocity of the ball, the straighter will be its course through the impinged body,"—a matter of great importance to the surgeon as to his prognosis and treatment, and which may be pretty accurately ascertained by investigating the circumstances under which the injury was sustained. 2dly. " The greater the velocity of the ball, the more the wound will approach to the nature of an incised wound." 3dly. " The greater the velocity of the ball, the greater will be the danger of hæmorrhage;" although gun-shot wounds, like other contused wounds, have generally but little tendency to bleed upon their first infliction.

Gun-shot wounds being generally attended with the death of the parts struck, must undergo a process of cure differing from that of an incised wound. Still, I am almost induced to consider the frequent repetition of the term "gun-shot" wound improper, as it leads to the belief that there is some abstract importance implied in the term; while the fact is, injuries from this cause differ in no respect from those accidents, in which the intensity of the force, however produced, is sufficient to destroy the vitality of the injured part. Any violent concentrated force may produce the same results as a gun-shot wound, and therefore all extreme contusions from machinery and railroad accidents offer precisely similar pathological considerations. Monographs on gun-shot wounds, or, indeed, on any surgical subject, are therefore somewhat dangerous, as they lead pupils, more especially, to consider the subject as separated from the general principles of surgery.

When any part of the living body is, by the violence of the inflicted injury, deprived of its vitality, it cannot possibly unite by adhesion, but the dead part must first be thrown off by the sloughing process, and the wound will ultimately heal by granulation.

The form and appearance of a gun-shot wound depend upon the shape of the projectile by which it is produced, and upon the violence with which the missile has been propelled. Ordinarily, however, a gun-shot wound presents the following characters: it is surrounded by a blackish zone, the bleeding is usually not very profuse, unless it happen that a large artery be partially cut through, when, of course, the hæmorrhage is in proportion to the size of the injured vessel. Sometimes the wound is quite dry; the pain is dull and heavy, and the patient seems overwhelmed by an insurmountable sense of oppression. This is particularly a symptom when he has been struck by a heavy projectile, without any external wound having been produced. A more acute pain generally supervenes at a later period, with a violence depending upon the extent of the injury, and the constitutional peculiarities of the patient. Sometimes it appears that pain is altogether absent; and this is said to be the case most frequently when a limb is carried away by a large shot. This insensibility occasionally extends to the whole body, and may be attended by tremblings and convulsions. The skin is generally more or less discoloured, and appears of a yellowish tint; it may, however, remain quite healthy, even when the deeper-seated tissues are severely contused. There is usually considerable swelling, which differs in character according to the circumstances attending the infliction of the injury.

Gun-shot wounds may be *simple* or *compound.*

They are termed *simple* when the ball passes through the soft parts only, as muscles and integuments, and are not attended with the same danger as when more important parts are implicated. I have known several instances of soldiers who have received severe wounds, and have become conscious of the fact merely from observing the trickling of blood, and from a sensation of slight faintness.

A compound gun-shot wound may be divided into three classes —1st, those in which a bone is broken: 2dly, those attended with the division of a large artery; 3dly, those penetrating one of the cavities of the body: under each of these circumstances, the ball must have penetrated the body; very severe results often follow, however, from the effect of a blow from a spent ball, without any apparent lesion of structure, in which perhaps the skin may remain intact, and yet some deep-seated organ be lacerated by the violence of the contusion.

With regard to the difference between the character of a penetrating gun-shot wound and a contusion, a very interesting, and at the same time apt illustration, may be drawn from physical science. We know chloride of nitrogen and gunpowder both to be most explosive bodies; the former, however, is reduced to its constituent elements in a space of time infinitely shorter than the latter, and with a force much more suddenly excited, and at first sight apparently greater, but the real amount of force generated is probably in favour of the latter, while the initial velocity communicated, is in favour of the former. You may easily demonstrate the difference of the action of these two substances. If a few grains of the chloride of nitrogen be placed upon an earthenware plate, and exploded, a clean round hole is made in the plate, without producing even a crack in it. Explode a similar quantity of gunpowder in a plate, and, if not confined, it produces no effect, but, if confined in its action, it smashes the plate all to pieces. Thus, in gun-shot wounds, the velocity is so great, that it annihilates the cohesive force of the atoms of the matter on which it impinges before there is time for the elastic force of the surrounding matter to come into play to resist it, and the destruction is confined to the immediate path of the ball; while in contusions from a spent ball, the velocity is less rapid, and before the force can overcome the cohesion, the elasticity of the structures comes into play, and thus affords a resistance, which prevents the ball from forcing an entrance. At the same time, so large a surface of matter has been brought into action to resist the ball, that the shock is far more widely felt than in the former case.

A similar illustration is afforded by the newly-discovered explosive body, "gun-cotton,"—the danger in the use of which arises from its sudden conversion into gas, bursting the gun before the elastic force of the metal can resist it; while gunpowder, from its gradual development of gas, enables that force to come into play, and to resist its pressure on every side, excepting that on which the ball lies, and so the ball is propelled along the barrel. The case of incision is the same as that of a ball of great velocity; only, in this case, the elastic force is prevented from being called into play by the cutting edge of the instrument employed, separating the atoms mechanically, and thus at once destroying the very condition of their elasticity,—namely, union and cohesion.

The perfection of this mechanical severing, however, depends on the perfection and fineness of the cutting edge, as a blunt edge, or a jagged one, reduces the wound to the class of contusion by its bringing into action the elastic resistance of the surrounding tissues. All wounds, then, may be considered as more or less of the character of *incised*, or *contused wounds*, according as the instrument of infliction has called into play with greater or less energy the elastic property of the surrounding parts of the body.

I shall first describe to you the treatment of simple gun-shot wounds, in which the soft parts only have been penetrated. The first object is to examine if the ball has made its exit or is still lodged in the body. The wound made by the entrance of the ball is small, and its lips are inverted, discoloured, and valvular, while the opening through which the ball has made its escape is much larger, with an everted and ragged edge. Should the ball not have passed through, it will probably be found on the opposite side of the limb to that on which it had entered, being merely retained by the elasticity of the skin, which should in that case be divided, and the ball removed, with every other extraneous substance that can be felt by the introduction of the finger into the wound. The wound should be thoroughly cleansed, and a bread and water poultice, or lint dipped in warm water, applied. A ball will often strike the thorax or abdomen on one side, and make its exit on the other, so as to give every appearance of having passed directly through the cavity, while in fact it has made a half circuit of the body, having its course altered by striking a rib or even the abdominal muscles, and being then directed in its circuitous course by the toughness and elasticity of the skin.

If in such a case there be no symptoms of severe collapse,—no escape from the wound of any secretion indicating injury to any important organ,—if, in short, the patient displays no symptoms of a vital function being disturbed,—there is great reason to believe that the ball has only penetrated unimportant parts, and that the wound is a "*simple*" one. The course of the ball should now be examined, and its progress may generally be traced by an elevated line (termed a wheal) of a dusky red colour, and very frequently at the termination of this wheal the ball will be found, if it has not made its exit, which would be indicated by the presence of a counter-opening.

When there are no physical signs of the direction which the ball has taken, nor any counter-opening to prove its having passed out, the surgeon must form his opinion of the extent of injury, positively, from the symptoms presenting themselves; or, negatively, from the absence of urgent signs of any internal organ being wounded. The following case will illustrate the application of these views:—On the 31st of January, 1839, Mr. Francis Toulmin, of Hackney, was sent for to Mr. A., æt. 23, who had just received a severe gun-shot wound in the abdomen, under the following circumstances:—He had been shooting in the marshes with a friend, and, on returning home, his friend walking behind him, Mr. A. turned half round to address him, when his companion's gun went off within two feet of him, and lodged the whole of its contents in his body. Mr. Toulmin was sent for. Upon examination, he found a large lacerated wound, with discoloured and ragged edges, about two inches and a half above, and to the right of the umbilicus. There was no counter-opening, but some discoloration of the skin was perceptible, extending from the wound transversely to the left for about two or three inches, showing the course of the shot. There was but little bleeding from the wound, which readily admitted three fingers, and the rectus muscle could be felt partly torn asunder. It was ascertained that the charge had passed through a coat, waistcoat, trousers, braces, riding-belt, shirt, and elastic shirt. Mr. Toulmin found the patient in a state of collapse, and looking as if he had received a mortal injury. He was placed immediately between the blankets, and some hot brandy and water was ordered. At 6 P.M. he had rallied, and twenty drops of laudanum were given him by Mr. Toulmin, who desired it to be repeated at bed-time if he were restless.

Feb. 1st.—Had had some sleep during the night. Tongue dry and brown; skin warm; pulse 120. Effervescent medicine, with hyoscyamus, was ordered.

2nd.—8, A.M.—Had some sleep during the night. At Mr. Toulmin's request, I was sent for, and saw the patient at about 11 A.M. A blush of inflammation extended to the right of the wound; pulse 120: tongue dry and brown. Chicken broth and calomel and opium prescribed. I examined the wound, and could not feel any extraneous substance; but, from the symptoms, I gave it as my opinion that the cavity of the abdomen was not injured, in which Mr. Toulmin perfectly agreed. We determined, on the strength of this conviction, to exhibit a castor-oil enema.

3rd.—Has had a bad night, very restless, but without much pain; no tympanitis; bowels not relieved; pulse 120; tongue dry, and rather brown; an erythematous blush over the whole of the right side. I made an opening about four inches from the original wound, and removed a quantity of cloth, a coat button, half a brace button, a piece of riding-belt, with a buckle attached, some wadding, and about twenty shot. The patient expressed himself at once relieved of great weight and tightness, and his pulse became slower. Was ordered six drachms of castor oil, and to take twenty-five drops of Battley's solution at bed-time, if the bowels acted.

4th.—Passed a quiet night, and had only taken half of the draught. Erythema lessened; bowels not opened; pulse 114; tongue dry. 3 P.M.—Had an enema, which acted in a short time. Saw him in the afternoon, and removed some more shot and cloth from between the original wound and the opening made yesterday. 9 P.M.—Great restlessness; pulse 100; tongue dry and brown; bowels open. To take his opiate draught, and to repeat it if it does not procure sleep.

5th.—Had some sleep; pulse 96; tongue still dry and brown. Ordered soda water and milk, which he relished. Fresh opening made, and some more cloth removed; the discharge from the wounds copious and purulent. Ordered the night draught, an enema in the morning, and effervescent mixture.

6th.—Better night: had his bowels relieved without the enema; pulse 96; tongue cleaner; profuse discharge; sloughs separating.—Stale beer grounds poultice. Wine and water and night draught ordered.

7th.—Quiet night; tongue still dry; pulse 102, no motion.—To take castor oil directly.—No motion, but an enema produced a copious evacuation.

8th.—Better in every respect. Tongue cleaner; copious purulent discharge from wound.—Arrow-root and beef-tea; wine and water. At 6 P.M. was not so well; erythematous inflammation extending over the right hip and down the thigh.—Punctures made in the skin, and poultices ordered. Continue night draughts.

9th.—Tranquil night; tongue still dry.—To continue arrowroot and beef-tea, and to increase the quantity of wine. In the evening he was restless, and the inflammation of the integuments of the hip and thigh increased, and was attended with some pain. An opening was made about two inches in length in the upper part of the thigh. Some pus was evacuated, and in a few days portions of shirt came away, after which the wounds gradually healed, and the cure was completed in about six weeks.

I am obliged to my friend, Mr. Francis Toulmin, for the detailed history of this case; and a very interesting one it is. The first point to direct attention to, is the treatment Mr. Toulmin adopted to produce reaction. In this case it was quite right to induce reaction as quickly as possible, because there was *no hæmorrhage,* and therefore not only was nothing to be feared from it, but an advantage to be gained; for, had there been any lesion of the abdominal viscera, a reaction was essential to permit of adhesive inflammation setting up at once a barrier to the effusion of the contents of a wounded viscus into the peritoneal cavity. Secondly: the reaction, to the extent that it occurred, and the rapidity with which it was produced, was a sufficient evidence of the viscera of the abdomen not being wounded, and therefore we were enabled early to employ purgative medicines as an antiphlogistic remedy; while, on the contrary, had there been any suspicion of intestinal injury, purgatives would have been most injudicious, even if the bowels had remained constipated. Having decided in our minds upon this point, the treatment, as will be observed, was merely to combat constitutional irritation, as if arising from any other cause; viz., to remove the topical exciting causes of irritation, and to allay the febrile action by restoring the secretions to their natural condition.

Upon entering the body, a bullet will sometimes assume a very extraordinary deviation from a direct course. Singular as this may at first appear, we shall have no difficulty in accounting for it, if we consider, that, when a bullet is propelled from a musket or pistol, it is endued with two distinct motions—one of progression, the other of rotation on its own axis; when the velocity of the ball becomes diminished, the motion of rotation exceeds that of progression; and it is under these circumstances that a bullet will take the indirect course through the body sometimes witnessed in gunshot wounds. It sometimes happens, also, that a ball will strike obliquely to the direction of the tissues, which offer, consequently, an unequal degree of resistance, and, therefore, turn the ball out of its rectilinear course.

In evidence of the eccentric course balls sometimes take, I will relate a case. Major G., of the Artillery, was wounded in a duel; the ball struck him at about the eighth rib on the right side, and made its exit as nearly as possible at the corresponding point on the opposite side. He exclaimed directly he was shot through the body, but did not fall. No severe symptoms, such as spitting of blood, or emphysema, followed; nor was there any indication of the viscera of the chest being wounded, and nothing retarded his recovery but the formation of abscesses in the course of the ball, caused by the leather in which it had been enveloped, and the pieces of cloth which had been driven in with it. It is not a matter of so much importance as might be supposed, that the ball should be extracted, as there are very many instances of persons in whom a ball has remained without producing any ill effect by its presence. Indeed, it frequently happens that additional injury is inflicted by a prolonged search after the ball. I remember seeing Sir Astley Cooper remove a ball from an officer in the India service, who had been wounded eighteen years before, and never suffered after the first effects of the wound, until a fortnight previous to the operation I allude to. When riding one day in the park, his horse plunged severely, and threw him upon the pommel of his saddle; the blow gave him great pain at the time, and it continued unmitigated for several days. Sir Astley Cooper was sent for, who found a moveable tumour just at the tuberosity of the right ischium, which he thought was a portion of that process broken off. He cut down upon it, and removed a pistol-ball, which eighteen years before had entered just by the posterior and inferior spinous process of the ilium, and had worked its way to the position whence it was removed: there can be no doubt it had remained quiescently embedded in a cyst of lymph, until disturbed by the accident resulting from the restiveness of the horse.

Nevertheless, extraneous substances introduced into the body may change their position, from the influence of muscles under motion; or, even after they have become encysted, some source of irritation may be set up, and suppuration supervene. Under these circumstances, the ball may change its position: but in the case just described, it is clear that the moving of the ball resulted from the violent bursting of the cyst itself.

It may be observed, from the history of these cases, and their results, that there is nothing specific in the treatment of "simple gunshot" wounds, but that general surgical principles are as applicable to them as to mechanical lesions from any other cause which produces the death of the injured part.

Many different statements have been made respecting the appearance and comparative size of the openings made at the entrance and exit of the bullet. It has been said, that the hole by which it enters is smaller and cleaner than that by which it leaves the body, which is ragged and more gaping. This does not, however, seem to be correct; the opening by which the ball enters appears to be generally somewhat the larger of the two. But, in fact, there is so little difference between them, that unless the direction of the shot were previously known, it would be impossible to say by which opening the ball entered, or by which it left the body.

I have said that Mr. Hunter denominated it a "compound gunshot wound" when a bone was fractured by the ball; and this accident must also be considered as a compound fracture, as there must necessarily be an external wound communicating with the fractured extremities of the bone. But even without the fracture of a bone, a gunshot wound may be considered as compound, or, at any rate, deviating from the simple kind I have described: for instance, when a ball presses upon any important part, as an artery, or a nerve, in which case it may become necessary to cut down upon it, and remove it; although, generally speaking, but little advantage is gained by seeking for the missile, and making incisions for that purpose.

When a bone is broken by a ball, the case differs but little from compound fracture from any other cause, beyond the impossibility of the wound uniting by adhesion, for reasons already given, and, perhaps, from the comminution of the fractured bone. In such cases, as in compound fracture from any description of accident, the principal point to be considered is, whether the limb is to be amputated, or attempts made to save it. The surgeon decides upon this point by a strict investigation into the nature of the accident,—as to the extent of injury of the soft parts, lesion of arteries and nerves, implication of joints, or comminution of bone; and also as to the condition and general health of the patient. If he has reason to believe that the hopes of reparation are very slight, either from the severity of the lesion, or from the want of constitutional power to support the process, the limb should be removed as soon as reaction has taken place, should collapse have resulted from the wound. It is, however, often a difficult matter to decide for the best on such occasions: for it not unfrequently happens, that patients sink under the protracted efforts at reparation, where attempts have been made to save a limb. And, on the other hand, when surgeons have recommended amputation, under the belief that the injury could not be repaired, patients have refused to submit to the operation, saying they would rather die, and yet ultimately have perfectly recovered; this only proves that our appreciation of the powers of nature is not, and cannot be, always correct. Last summer, I was requested to meet Mr. Francis Toulmin, of Hackney, to see a patient who, a few days before, had received a very severe wound on the upper extremity of the left humerus, under the following circumstances:—He was visiting a public garden, to witness a display of fireworks, and, while looking on, felt what he described as a smart blow on the shoulder, as if struck by a stick, and on putting his right hand to the part, he was astonished to find it covered with blood. He immediately went home, and sent for Mr. Toulmin, from whom I obtained the following account of the case:—

"I saw him a few minutes after his arrival at home, and found that he had received a severe ragged wound through the deltoid muscle; the wound was fully three inches in breadth, and had separated the muscle from its attachment to the bone, to which I readily passed my finger, and for some considerable distance downwards, but could not discover any fracture. The arm below the wound was greatly swollen; there was no hæmorrhage, but the patient complained of considerable pain: an opiate was ordered, and the whole length of the upper arm was covered with lint, dipped in warm water, and surrounded with oil silk. On the following day, the swelling of the arm had considerably abated, but there was a high degree of constitutional irritation. Calomel and opium were ordered, with saline draughts. During the night I was called up to him, in consequence of the severity of the pain, for which I gave him an additional dose of opium, and promised to visit him early in the morning. At eight o'clock, A.M., I saw him, and thought I could feel some extraneous body; I therefore made an incision four or five inches below the original wound, and removed a piece of a rough iron pot, about three inches square, in which combustibles had been placed, and which, having burst, had produced the wound in question. The iron pot having been placed on an elevation, had necessarily taken a downward direction. A phlegmonous erysipelatous inflammation, extending from the shoulder to the hand, followed the injury; this was relieved by incisions through the fascia, which were made anteriorly and posteriorly, both above and below the elbow, with great relief to the patient." During this period, I had frequently seen the case with Mr. Toulmin, and had no suspicion of the humerus being fractured. "At the end of a fortnight, in attempting to rise in bed, the patient felt something give way, and on the following day it was discovered that the bone was broken at its upper third, and the fractured ends much displaced. After dilating the upper and original wound, and removing some portion of the bone with a saw and bone-nippers, we succeeded in bringing the ends of the bone in perfect apposition; and, by the aid of splints, retained them so. The bone quickly united; various portions of dress, however, and small exfoliations of bone, for some time continued to pass through the wounds in the upper arm. The patient, at the end of three months, was able to resume his business of a publican, and has now as good a use of his arm as he ever enjoyed."

When I first saw the patient, I confess I thought there was considerable doubt whether the arm could be saved; and when it was found that the humerus was fractured, Mr. Toulmin and myself both agreed that we should have recommended amputation of the limb, if the condition of the patient would have rendered the operation admissible. There was some doubt entertained whether or not the arm was fractured by the original injury,—my opinion is that it was; and I am inclined to attribute the failure in the detection of the fracture to the portion of iron plate, which so completely covered the extremities of the bone, that when the fingers were passed into the wound, to search for extraneous substances (as had been frequently done), the bone could never be felt; and, moreover, the piece of iron gave to the limb a degree of solidity unusual in cases of fracture, and so caused a further difficulty in the detection of the nature of the accident. I have no doubt, moreover, that the subsequent sudden displacement of the fractured bone occurred from the loss of this support, upon the removal of the iron plate. The rapidity with which the bone ultimately united was, to me, unexpected, considering the extent of injury to the surrounding soft parts, which are so essential to the formation of the provisional bone; but notwithstanding the severity of the local injury, the excellent constitution of the patient overcame all the difficulties.

When a gunshot wound is complicated by the division of an artery, and severe bleeding, the case requires precisely the same treatment as injury to arteries from other causes, namely, that the hæmorrhage should be stayed, either by tying the vessel at the wound, or cutting down upon it above the seat of injury; or, if there be, as may happen, too great a destruction of parts to allow of a hope of restoration, the limb must be amputated at once. Such remarks refer to the occurrence of bleeding immediately on the infliction of the wound; but secondary hæmorrhages often occur during the process of separation of the dead from the living parts—a process inseparable from the reparation of a gunshot wound. Under these circumstances, whether the artery is to be tied above the slough, or the limb amputated, depends upon the same surgical principles as regulate the practice in bleeding arteries from other causes. The constitutional powers of the patient must decide the point. If it be determined to apply artificial means to check the bleeding, and to attempt to save the limb, a ligature should at once be applied to the artery, for I have never seen any good accrue from the application of styptics, pressure, or any other half measures; while, if they fail, as they generally do, a recurrence of bleeding is likely to place the patient in a condition beyond recovery.

I shall be able more fully to explain this doctrine when speaking of amputations.

It is remarkable, in gunshot wounds, how generally arteries escape being wounded by balls which will almost dissect them from the surrounding structures, and yet leave them intact. This has been attributed principally to their elasticity. It is equally wonderful, when arteries are torn asunder by shot, how little blood is lost; perhaps only a few drops may be discharged, and the vessel often becomes permanently obliterated by the same process as that which closes it upon the application of a ligature. When balls penetrate the cavities, the symptoms immediately arising form the best proof of whether or not the viscera be wounded, and generally the discharges from the wound throw light upon the subject.

In injuries of the head, the symptoms arising from gunshot wounds, and the appropriate treatment to be adopted, so completely correspond with injuries from any other cause, that I shall defer speaking of them until I arrive at the subject of injuries to the skull.

In wounds of the thorax, injury to the viscera is more decidedly marked, both as to extent and danger, than in wounds of the head; and bleeding is the principal symptom to be attended to, whether the blood issue from the wound itself, or be coughed up with mucus; and in proportion to the quantity expelled, is the danger to be dreaded. It does not, however, necessarily follow that the lungs are wounded because blood is expelled; as a ball, in its passage through the chest, may not actually enter the lung, and yet produce lesion of its vessels. But, under these circumstances, the bleeding is neither immediate nor profuse, and is unattended with violent dyspnœa. Under all circumstances of wounds of the chest, the great desideratum is to diminish the quantity of blood sent to the lungs; this object is attained by bleeding, which must be freely employed, repeating it to the utmost so long as blood is coughed up, and the dyspnœa urgent. The patient should be kept cool, perfectly quiet, and in a state approaching nausea, by tartarized antimony and opium. I place great reliance on the use of opium, as, by allaying irritation, and inducing sleep, it keeps the lungs in the greatest state of quietude which can be obtained. It is to be remembered, that, during sleep, both respiration and the pulsations of the heart are greatly diminished, and therefore this treatment is indicated. A broad roller should be applied around the chest, taking care not to cover the wound; and the patient should be placed in such a position as to facilitate the flow of blood through the opening when there is any tendency to hæmorrhage from that source. Should reaction take place, and hæmoptysis recur, even after all these means have been adopted, the lancet must be again called into requisition, even to the verge of danger from its use; it is, in fact, the only chance left of saving the patient from suffocation. The Duke of Richmond, who was shot through the lungs at the battle of Orthez, owes his life to the promptitude of the surgeon under whose care he, fortunately for himself, fell. Directly blood has ceased to flow from the wound, it may be closed by simple dressing; and if the hæmoptysis has ceased, cooling acidulated fluids containing nitrate of potash, or some other neutral salt, may be sparingly given. If, during the treatment, the patient faints from bleeding, the surgeon may safely pass his finger into the wound to search for an extraneous body; and, perhaps, it may be necessary carefully to enlarge the wound with a probe-pointed bistoury for its extraction. The enlarging of the wound may also be advisable when a large quantity of blood is extravasated into the cavity of the pleura, which would be indicated by an increasing sense of weight and oppression, as well as by the dulness on percussion, bronchophony, tubular breathing, &c.: emphysema, also, might lead to this necessity. The after-treatment I need not dwell on, as it must be regulated by the peculiarities which offer themselves in each individual case,—the great object being not too early to allow the patient to indulge in any luxury of diet; although, at the same time, the powers of the constitution must be maintained, to prevent the liability to dropsical effusions following the severe depletion which has been required.

Gunshot wounds of the abdomen lead to the most important considerations, and, perhaps I may say, offer greater difficulties to the surgeon, in forming just diagnostic and prognostic conclusions, than wounds of the head or thorax, in consequence of its size being less determined, its parietes being made up chiefly of muscles, while the cavities of the head and chest are more defined, from the quantity of bone which constitutes their walls. In the firm, contracted, bony, and fixed parietes of the head, slight depression, effusion, or any change which tends to occupy space, immediately produces such marked functional disturbance as to be readily recognised; but the abdominal cavity admits of great increase or diminution of its capacity without any immediate effect being produced upon the important viscera contained within it, or any decided indications of the extent of the injury.

Gunshot wounds of the abdomen, as, indeed, injuries from the application of violence from any other cause, must be considered under the following heads:—

1st. *Simple contusion of the abdominal parietes.*—This kind of accident frequently occurs to civilians in their daily occupations and labours, but could rarely arise from a gunshot wound, although such circumstances are recorded as resulting from the mere wind of a ball. I place but little faith in this, for I saw near Bayonne a 32-pound shot pass between the thighs of an artillery officer, and knock the tail of his coat off, while he was in the act of "laying" a gun. The shot was fired from a frigate lying in the river not more than two hundred yards from him, and if the wind of a shot could do anything, the gallant colonel would not, I think, be able to boast of the fine family he has now reason to be proud of. Contusions of the abdominal parietes, from whatever cause they occur, are to be treated with fomentations, rest, and general antiphlogistic remedies, which will be pretty generally found sufficient to restore the patient to health: but this must not be expected to prove invariably the case. Urgent symptoms, even collapse, may follow, so as to render it extremely difficult to form a correct diagnosis: under such a difficulty, the prognosis must be withheld until reaction has taken place; to produce which it may be necessary to apply warmth, or even administer stimuli.

When the natural action of the heart and the general heat of the body are restored, and all fear of collapse removed, there will be sufficient reason to consider the injury as merely appertaining to the parietes of the abdomen, without lesion of any of the viscera. But still considerable precaution is necessary, in consequence of the liability to peritonitis after these accidents. Therefore recumbent posture, and a strict antiphlogistic regimen, should be enjoined; for a surgeon is culpable who would allow symptoms of inflammation to appear, and then apply as remedy, what might have been previously employed as a preventive.

When the parietes of the abdomen are wounded, without either protrusion of, or injury to its contents, there is but little difference to be observed in the treatment from what has been recommended in their mere contusion; but there is often some difficulty in ascertaining whether the peritoneum, or even any viscus be injured, especially if there be no signs of collapse concomitant with the injury. A finger should be passed into the wound to examine its depth, and the direction the ball has taken, every extraneous substance removed, and a light poultice laid over the abdomen. Purgatives should be avoided, until all apprehension of injury to the intestines has subsided; and then the only object to be attained is the healing of the wound, which may be hastened by judicious topical and constitutional remedies.

But, as I have said, the extent of injury which has been sustained in wounds of the abdomen, is sometimes extremely difficult to ascertain; this is illustrated by the following case, in which I formed a wrong prognosis, although I followed the principles I have laid down.

A few years ago, I was sent for to a gentleman, Mr. D., who had, about an hour before I saw him, been shot by an assassin. He had just got into bed as I arrived at his house, and I had therefore the opportunity of immediate examination. I found him perfectly free from any symptom approaching to collapse, his countenance natural and lively, the temperature of his body normal, his pulse unaffected; and he complained of no more pain than was inseparable from a flesh wound so recently inflicted. Upon examination, I found a wound in the back, where the ball had entered, situated about the angle of the seventh or eighth rib; I passed my finger into the wound to search for the ball or any extraneous substance, but could not detect anything, nor any indication of the bullet having passed into the chest. No counter opening, no air passing, no emphysema, difficulty of breathing, spitting of blood, nor any dangerous symptom whatever. At this moment another surgeon, who had also been sent for, entered the room, and we proceeded to examine the body more generally, to discover, if we could, the course the ball had taken, when, on the fore part of the abdomen, close to the umbilicus, we detected a hard substance immediately under the skin, which was divided with a common lancet by Mr. ——, and the pistol-bullet rolled out. The question now arose as to the course the ball had taken; I gave it as my opinion, in the strongest terms, that the ball had not entered either the chest or the abdomen, as from the complete absence of any symptoms of collapse, it was quite certain no important organ was wounded, but

I said that I suspected a rib was broken, as he had a slight catch in respiration. The next day the patient was not so well; he became restless, and complained of uneasiness rather than of pain in the abdomen, and most vigorous antiphlogistic means were adopted by letting of blood. Not a symptom of collapse supervened; the bowels were freely opened, the secretions were duly performed, but in less than a week he died. On examination of the body, the ball was found to have passed through the posterior and inferior angle of the chest, between the base of the lung and diaphragm, without touching the lung, so that it probably made its transit during the act of expiration; it then passed through the diaphragm, skirted the stomach, perforated the great omentum between the stomach and transverse arch of the colon, and, without wounding a single viscus, lodged in the muscular parietes of the abdomen; so that, although I was wrong in my conjecture as to the ball not having entered the great cavities, I was quite correct in my view of no vital organ being wounded, and who could have believed the ball could have taken the course it did, without wounding the lungs, or some of the abdominal viscera? About a pound of blood was found in the cavity of the abdomen, but no signs of inflammation, which had probably been prevented by the quantity of blood which had been abstracted. Another case, which I witnessed during the Peninsular war, offers so strong a contrast to the last, that I think, without fear of suffering the imputation of seeking military éclat, I may venture to recite it. At the battle of the Pyrenees, a sergeant, sitting by a road side, attracted my attention by his pallid and pitiable countenance. I asked him where he was wounded; in a low tone of voice, he said he was shot in the body. There was a hut close by, and I had him carried in: we stripped him, and found a small valvular discoloured opening just below the umbilicus; nothing exuded from the wound but a drop of blood. The surface of his whole body was cold, although he complained of the sensation of great internal heat, his pulse could scarcely be felt, his abdomen was becoming tympanitic, and death was stamped on every feature of his countenance. He was wrapped up in warm blankets, and I left him. I went the next day to see him, as we had not moved far from the spot, and found that he had never rallied for an instant, but had died in great pain about ten hours after I had left him. Such are the symptoms I have invariably seen follow wounds of the abdominal viscera; and such a sequel I have witnessed, more than once, in cases of hernia, when the intestine has given way, or been accidentally wounded in the division of the stricture.

When the viscera protrude through a wound in the parietes of the abdomen, the propriety of returning them depends upon the condition in which they are found; they may themselves be wounded, or have been so long exposed to the air, as to be unfitted for restoration to their natural cavity. In gunshot wounds they are very liable to be torn; but when the wound of the abdomen has been inflicted by a cutting instrument, the viscera more frequently escape lesion, though they often become protruded through the opening, which, indeed, sometimes requires to be dilated before the intestine can be returned.

When the intestines, as well as the parietes of the abdomen, are wounded by a shot, there is generally little left for the surgeon to do; but the treatment which alone can avail in these cases, is so precisely similar to what is to be followed in strangulated hernia, when the intestine has given way, either from sloughing or ulceration, that I shall postpone the account of the mode of treatment to be adopted until I treat of hernia especially.

The last class of injury to the abdomen I have to describe is, that in which the viscera are ruptured without any wound through the abdominal parietes. A spent ball is the most likely kind of agent to produce such an effect. This is not an uncommon accident to meet with, either in military or civil practice, and it offers little hope from remedial assistance.

The symptoms which are produced by the rupture of an intestine, or, indeed, any of the important viscera, from a blow on the abdomen, are usually sufficiently well marked to point out the precise nature of the injury which has been sustained. From a state, perhaps, of robust health, the patient is at once reduced to the most hopeless state of prostration; the cold sweat which overspreads his body, the ghastly anxiety of the countenance, the scarcely-to-be-felt pulse, and his own conviction of approaching death, all indicate the fatality of the injury; and one of the common expressions of the sufferer is, that all medical efforts are in vain, for that he feels "struck by death." Such urgent symptoms, perhaps somewhat less violent in degree than what I have described, do, however, sometimes supervene upon a blow on the abdomen, without any rupture of a viscus having occurred; indeed, many cases are on record, of persons having dropped down dead, from only a slight unexpected blow on the scrobiculus cordis, and without the cause of death being afterwards apparent: so sometimes does a blow produce collapse immediately on the infliction, the effects of which, however, are transitory, and reaction comes on, either spontaneously, or by the assistance of stimuli; therefore a surgeon is not always in these cases to consider collapse as indicative of a hopeless state. In such cases as those in which reaction takes place, the antiphlogistic regimen should be adopted, as soon as the pulse and return of the natural warmth of the body point out the restoration of the vital powers; and this with the view of preventing peritoneal inflammation, which is so likely to follow. Purging, however, is not to be the means employed for subduing, or rather keeping down inflammatory action; for should an intestine have received such an injury from the blow as to produce its ulceration, although it may not have ruptured it, the employment of purgatives, by increasing the peristaltic motion of the bowels, would disturb the means by which nature repairs the hurt which the intestine had received. So that I should say, in cases of supposed rupture of intestine without a wound in the parietes of the abdomen—in cases of wounded and protruded intestine—in cases of ulcerated intestine, in strangulated hernia—or even in the case of ulceration of a bowel, caused by protracted chronic inflammation, purgatives should be avoided, at least, until time has been given for nature to exert her efforts, undisturbed, to repair the injury, although in each case, should reaction come on, the antiphlogistic plan of treatment must be adopted.

LECTURE IX.

BURNS AND SCALDS.

Burns and scalds—Difficulties in their treatment—Effects of heat and cold upon the skin—Classification of burns—Rubefaction—Vesication—Danger of exposing the cutis vera—Suppuration—Ulceration and destruction of cutis—Sloughing and gangrene—Local treatment of each—Internal remedies in burns—Ulceration of the duodenum—Mr. Curling's and Dr. Hodgkin's hypotheses—Case of ulcerated duodenum and phlebitis after a burn—Permanent contractions following burns—Propriety of operating for their relief considered—Different operations for the removal of cicatrices—Case.

Common as the occurrence of burns and scalds is in the practice of every surgeon, I really think there is scarcely any class of accidents for the treatment of which there are fewer or less decided principles laid down. Nor does this arise from the unimportance of their effects, for the amount of mortality resulting from burns and scalds in every hospital is so great that they have always held a prominent place in the list of deaths from accidental causes; and during the recovery of those who survive there often arise the greatest surgical difficulties in preventing the awful contractions which so frequently attend the cicatrizing process.

The application of heat to the surface of the skin produces effects in proportion to the degree to which it exceeds or falls short of the natural temperature of the body: if, for instance, a person gets into a hot bath at the temperature of 104°, an increased action is excited in the skin, which leads to a prostration of strength in proportion to the length of time he is exposed to its influence; but it often produces a most salutary effect in certain affections of the viscera, proving the great importance of the natural functions of the cutaneous surface in maintaining the healthy condition of the body.

So, by the abstraction of heat from the surface, by plunging a patient into cold water, most powerful effects are produced. Again, if during the period of convalescence from scarlet fever or measles there be any thing to check transpiration through the skin, the patient is almost certain to fall a victim to the suppression;—in the first case, from an affection of the serous membranes, more especially that of the abdomen, and the areolar tissue generally; and in the second, from an affection of the mucous membranes, particularly that of the respiratory passages. In psora, persons have been known to die from having the cutaneous transpiration arrested, in consequence of the application of sulphur ointment being too widely extended over the body.

In pneumonia, intense heat of the skin is the great pathognomonic sign of the disease, and to check it by the application of cold is highly dangerous, for the lungs are incapable of performing their functions without the assistance of the skin. Cold to the surface of the body induces internal congestions. These facts afford so many proofs of the importance of the functions of the skin in the animal economy.

I make these preliminary remarks, to impress upon the mind the fact that no sudden change can be effected over a large surface of the skin without the constitution generally participating in the change. It will be easily believed, therefore, that when scalds or burns occur, the shock to the system will be in proportion to their *extent*, to the *importance* of the part injured, and to *the intensity* of the heat applied.

All bodies which give off caloric, can, if the temperature reach to a certain degree, produce a burn or scald. These bodies burn, either by the heat which radiates from them, the flame which is generated in their combustion, or by direct contact with the body burned. The burning body may be gaseous, liquid, or solid. When a burn is produced by radiating heat only, an increased flow of blood is determined towards the part, giving rise to a kind of erythema; and if the action be continued and intense, the superficial tissues of the parts exposed to it may be altogether destroyed. The slighter effect of radiating heat may often be witnessed in the action of the sun, in the summer season, upon the skin of delicate persons, where it indeed sometimes produces a kind of erysipelas. The effect produced by the application of flame to the surface of the body, is different to that of radiant heat; for not only does it burn as a heated body, in contact with organic matter, but it extends itself, as it were, to the body, which likewise begins to burn with flame—the destructive influence passing on to neighbouring parts, and deeper-seated tissues. Thus it is, that burns of this description are generally productive of such serious consequences, and so often lead to a fatal termination. Burns by direct contact are most frequently produced by heated liquids, and come more properly under the head of scalds; bodies producing burns by direct contact may, however, be either in the liquid, gaseous, or solid state. Hot liquids often produce burns, or rather scalds, of vast extent; the amount of injury then depends, in great measure, upon the density of the liquid (or rather, perhaps, upon the temperature at which it boils), and upon its capacity for heat: thus saline solutions, or syrups, produce a worse burn than water, and heated oils and fats give rise to still more frightful scalds. Burning gases or vapours, which of course act externally only as flame, possess, from their nature, the capability of penetrating or insinuating themselves into cavities, such as the nose and fauces; and then we have a modification of burning, which arises from a different tissue, the mucous membrane, being included in the mischief. When a burn is inflicted by a solid body in contact with the burned surface, the effect is limited superficially, but extends in depth, sometimes involving almost the whole thickness of an organ.

As to the arrangement of burns and scalds: I do not think they can be classified according to the intensity of the heat, the consistence and capacity for heat possessed by the fluid, or even to the length of time the heat has been applied, but rather according to the effects that have been produced by its application, which often penetrate beyond the surface, excite violent action, and become dangerous to life.

The effects of burning may, however, be divided into two kinds. 1st. Inflammation; 2nd. Disorganization: but some authors have classed burns according to four, or more degrees.

The most simple result from a burn or scald is a mere superficial inflammation, uncircumscribed, unattended with swelling, and accompanied by very little pain, the whole merely amounting to a slight turgescence of vessels—the caloric acting only as a rubefacient. This, unless egregiously interfered with, will very soon terminate spontaneously, probably with a slight desquamation of the cuticle. Even with this trivial local injury, if the patient be of a very irritable temperament, soothing topical remedies may be beneficially applied—as, for instance, cold white-wash; or, perhaps, the patient may find it more agreeable if gently warmed. Slight antiphlogistic and narcotic remedies may also, in some few instances, be combined with the local treatment. From the peculiarity of constitution, the same degree of heat may in another patient produce a greater amount of injury, and its influence may penetrate into deeper structures, and interfere with the vital powers of the true skin, occasioning at once, or subsequently, a separation of the cuticle from the surface of the cutis, and an effusion of serum between them; or a higher degree of temperature may produce this aggravated result.

In this case, the topical signs indicate the greater degree of injury sustained; the redness of the skin is greater, the pain more poignant, increased temperature of the surface is evident, and swelling soon supervenes. These are the signs of local inflammation produced by a cause which does not act in any way specifically, but which requires the usual means to allay its intensity, and to prevent its affecting the constitution generally.

Where the burn or scald is more severe at first, vesicles are formed, there is a considerable degree of reddening between the vesicles, and some swelling and tension of the parts. If the original injury be still greater, sloughing or gangrene of the parts will ensue, a thin scab will be produced under the form of greyish brown spots, which are painful when touched. These are produced by mortification of the cutis; sometimes the vesicles become covered with scales, and there is an effusion of a brownish bloody serum. In this gangrene the whole thickness of the skin, and sometimes a portion of the cellular tissue, may be destroyed; the scab is then deeper, and more dry and hard, or even horny, drawing into radiating folds the surrounding healthy skin. When the scab is removed, and suppuration commences, granulations of a kind peculiar to burns spring up, and, having an indefinite tendency to contract, draw the parts into abnormal positions, and are productive of the terrible deformities which are almost always more or less inseparable from severe burns.

When the heat applied to any part of the body is extremely intense or continued, the part may be entirely destroyed; in that case, it is completely carbonized, literally reduced to a cinder —a catastrophe which has occurred not unfrequently in metal foundries, where the workmen have accidentally placed their feet, or some other part of their bodies, in the course of the molten metal.

The removal of the exciting cause of inflammation is the first principle of the treatment of burns; and as heat has been the cause, and an abnormal amount of heat still remains in the injured parts, the application of cold seems strongly indicated. I confess, however, I have the same dread of applying cold to any extent in burns and scalds, that I have of applying heat in cases of frost-bite; the reaction induced is generally too great for the inflamed cutis to sustain, and instead of the inflammation becoming resolved, it is increased, fresh vesicles form, and symptomatic fever and other injurious effects result.

It might be supposed, that this may be prevented by continuing the application of cold without intermission,—and in some cases the adoption of this plan may prevent the dreaded reaction; but, by such treatment, I think the tendency to rigors is to be feared: for, as we have shown, when tissues are inflamed, the blood in their capillaries undergoes a change suited to the increased demand of the tissues for a supply of their constituents, there seems to be reason in the belief that the restringent action of cold must interfere with the intended reciprocal action between tissue, blood, and bloodvessels. Tepid applications are therefore the best.

When vesicles have formed, great care should be taken not to allow the cuticle to be removed. If it be rendered very tense by the quantity of serum beneath it, a valvular opening may be made with a small lancet to evacuate the fluid; still retaining the cuticle as a covering to the sensitive cutis. Most people must have experienced a practical hint of the use of this covering, in a blister produced in rowing, riding, or walking; for a large blister from either of these causes produces liitle or no inconvenience while the integrity of the cuticle is maintained; but only destroy it, and violent constitutional disturbance may follow the abrasion. It may be readily conceived, therefore, what must be the effect resulting from the exposure of a very large surface of cutis. Indeed, patients who have been extensively, but apparently only superficially, scalded, have been known to die in a state of collapse soon after the injury, merely from the exposure of the sentient extremities of the nerves of the true skin. The physical influence which the cuticle produces on the integuments when they are removed from the dead body, is as striking as the vital changes which are effected in the cutis by the removal of the cuticle in the living body.

If two portions of skin be taken, one with the cuticle removed, and the other retaining it, and exposed to the atmosphere, and even to the rays of the summer's sun, the portion on which the cuticle is preserved will remain supple and moist for two or three days, while the other will become shrivelled up and perfectly dry in a few hours. This, therefore, shows the importance to be attached to the preservation of the cuticle. If, by any accidental cause, or from injudicious interference, the cuticle has been removed from a vesication, the indication is sufficiently clear, namely, to find a substitute for it; hence flour, raw cotton, simple ointment, or any such remedies as are best adapted to preserve the sentient extremities of the nerves from the influence of external agents, are applied over the exposed surface; while constitutional remedies must also be had recourse to if there be indications of irritative fever supervening. Suppuration generally takes place from the cutis after vesications from a burn, but is not an invariable concomitant, as sometimes the plasma thrown out becomes organized, and the wound cicatrizes without the formation of pus. Suppuration, however, frequently does occur, and, becoming extremely difficult to check, may lead to great constitutional disturbance. If tonics and nutritious diet, with the application of simple dressings to the sore, do not check the suppurative process, I have known the following lotion prove highly efficacious:—

℞ Pulv. opii, gr. iv.;
Mucilag. gum acaciæ, ℥jss.;
Liq. calcis, ℥vjss. M.

Fiat lotio.

This lotion proves equally beneficial when ulceration accompanies the suppurative process, in which case opium is also required to be administered internally; in the case of children, the syrup of poppies is preferable. Chloride of lime in solution, and nitrate of silver, have also been recommended. The latter, I suppose, acts beneficially by destroying the sensibility of the extremities of the nerves, which may, perhaps, from their high degree of sensibility, keep up the ulcerative process; for how often do we find phagedenic ulcers checked at once by the use of lunar caustic. When the heat has been sufficient to destroy the sensibility of the cutis, or protracted inflammation has done so, stimulating applications will be found the most effectual remedies; in Guy's hospital we generally employ oil and lime-water, sometimes with a little oil of turpentine in it, or the ung. resinæ flavæ, either spread upon lint, or made into a liniment by being rubbed down with a sufficient quantity of spirit of turpentine to make it of a fit consistency to admit of being applied with a brush. In these more violent cases, support, and very often stimuli, are required; opiates to allay irritation, with due attention to the state of the excretions, more especially to that of the bowels.

But with every precaution, a great number of our cases of burns prove fatal. I must acknowledge, indeed, the large proportion of bad cases; and I believe the danger is as great when extensive surfaces are submitted to the influence of heat, although only superficially, as when the heat is more concentrated, and has extended its influence in depth rather than surface; this has certainly proved true in my experience, at least as far as refers to rapid dissolution.

This view does not, however, extend to such cases as those in which the intensity of the heat, or the long continuance of its application, has produced the total destruction of the parts to a considerable depth as well as extent, and the influence has probably been propagated to the interior of the body. Such gangrenous or sloughing burns usually occur from the clothes catching fire, the explosion of gunpowder or inflammable air, or from persons falling into brewers' or soap-boilers' vats.

Under these violent circumstances, the constitution is at once affected; rigors immediately come on; the whole surface of the body is cold; the pulse quick and small; the respiration short and hurried; vomiting and hiccough supervene, and the patient generally dies comatose about the second or third day.

All that can be done in these cases is, directly to protect the patient from any exposure to cold, and, if it be possible, the temperature of the room in which he is placed should be constantly maintained, at a high degree, for the first twenty-four hours; if the collapse be great and protracted, stimuli should be administered, and, as soon as reaction is restored, a large dose of opium given. The wounds should be covered over either with basilicon ointment, spread on lint, or the oil and lime-water dressing; and on those parts where the cutis is not destroyed, flour should be plentifully strewed.

Should the patient survive the first violent shock, he has yet much to go through during the process of reparation; he may fall a victim to the violence of the symptomatic fever preceding the restorative action, or he may ultimately sink from hectic fever, or from the slower exhaustion of vital power, resulting from profuse suppuration.

In deep and extensive burns, the peculiar circumstances under which the patient may sink are, I think, divisible into three different heads—pain, inflammation, suppuration; and, accordingly, the prognosis in burns depends upon whether the patient be young and irritable, robust and sanguineous, or whether he be debilitated, or the subject of chronic disease. The strong and robust patient is the one who, under most circumstances, stands the best chance of recovering; for although he is, perhaps, most liable to be attacked by excessive inflammation, he is best able to support the means necessary to subdue that inflammation.

Burns, especially when arising from the explosion of gunpowder, are said to be more dangerous than scalds; in my opinion, the comparative danger of the two is in proportion to the extent of cutis exposed. Therefore it ought always to be a chief object to preserve the cuticle as much as possible; and if the surgeon be present at the undressing of the patient, or assist in so doing, he should take great care that large portions of cuticle are not removed with the stockings, or other parts of the dress, as has been stated by the late Mr. Earle to occur so frequently from the roughness of assistants: this observation is most judicious. I cannot, however, agree with Mr. Earle in his proposition of plunging the limb into ice-cold water, for the reasons which I have already given; but if the patient were placed in a tepid bath, and his clothes cut off while immersed in the water, I believe the equable temperature which would thus be maintained would prove highly beneficial; while, at the same time, it would facilitate the removal of the dress.

As to the various local remedies which have been recommended in works on the treatment of burns, I should needlessly occupy space by describing them, for it is but rarely that the particular application is of importance, but the principles which dictate its use; and those principles are founded upon the just appreciation of the phenomena inseparable from the various stages of inflammation. In one burn we may have presented to our view the mere blush, not surpassing active congestion, of the vessels of the inflamed part; in another portion we may have vesicles, with the cuticle entire, or torn away, leaving the cutis exposed; or we may find the cutis destroyed, and in a state of slough:—how, then, could any treatment, either topical or constitutional, be laid down for general adoption? We must judge for ourselves, by a close investigation of all the circumstances of the particular case before us, and regulate our treatment according to the effect produced upon the constitution of the patient.

The employment of internal remedies in burns, as, indeed, in all other cases, must be regulated by the severity, and also the peculiarity, of the symptoms which present themselves; but I am perhaps safe in saying, that gentle antiphlogistic means, at the same time with support, narcotics, and sometimes stimuli, are very generally indicated.

During the progress of the case, every attention must be paid to the position of the body and limbs, so as to prevent, as much as possible, the contractions so frequently attending the cicatrization of wounds from burns and scalds, and which often lead to the most unsightly distortions.

Before I speak of the means which are recommended for the removal of these cicatrizations, I will mention one of the very frequent sequels of extensive burns, which was first observed by Mr. Curling, of the London Hospital.

Mr. Curling observed, that ejection of blood, both from the stomach and bowels, was a frequent occurrence after severe burns, and that death very soon followed such bleedings. This fact led him to a close investigation of the subject, and he took every opportunity of making a post-mortem examination of patients who died in consequence of severe burns; he discovered that ulceration of the commencement of the duodenum was a very common concomitant, and was invariable if hæmatemesis or purging of blood formed a prominent symptom. I cannot do better than quote Mr. Curling's own words, in his explanation of this important pathological fact.

"It would be interesting to inquire how it happens that in cases of burn, the first portion of the duodenum is peculiarly the seat of inflammation and ulceration, in preference to other parts of the intestinal tube. It cannot be attributed solely to the congestion of the mucous membrane, which commonly occurs after a severe burn, inasmuch as the remainder of the alimentary canal, though equally participating in the vascular disturbance, very rarely indeed becomes affected with ulceration. May it not be the effect of the sudden arrest of the important functions of a large part of the skin, not only of that actually injured or destroyed by the fire, but also of the parts which usually become afterwards inflamed to some extent round the seat of injury? The duodenum is furnished with peculiar glands, the true glands of Brunner, which abound in that particular part of the intestine, the seat of disease; and although their office, and the nature and uses of their secretion, have not been well ascertained, their size and number indicate that they must be capable of pouring out a large quantity of fluid, and that their functions in the economy are by no means unimportant. Now, it is seldom that the secretions of any organ can be suddenly stopped without injurious consequences resulting; and considering the importance of those of the skin, and the continuity of this structure with the mucous surface of the alimentary canal, we can scarcely be surprised that the duodenal glands should sympathize and endeavour by an increased action to compensate for the suppression of the exhalation from the skin, and that the irritation consequent thereon should often lead to inflammation and ulceration.

"Dr. Hodgkin seems rather inclined to attribute the ulceration of the duodenum to vomiting, and says, that in some instances it has been the cause of ulceration, as much as the ulceration has been the cause of keeping up the vomiting."

This difference of opinion may, it seems, be easily settled by further investigation; for if it be true that vomiting will produce ulceration in the duodenum, surely we should find it after the obstinate vomiting which so frequently occurs in cases of hernia, and other obstructions to the alvine excretions, and in which the absence of hæmatemesis does not lead us to anticipate such a condition.

I will now relate a case which occurred in Guy's hospital under Mr. Morgan, where there was not only ulceration of the duodenum, but also partial phlebitis. Thomas Wallis, æt. 8½ years, was admitted April 13th, 1847, for a burn, which extended over the back of the head, the neck, and the right upper extremity. In some parts, especially about the head and neck, it was very deep. He was partially collapsed when admitted, and was treated in the usual way. The burn itself was dusted with flour. Sloughing, which soon commenced, lasted about a fortnight. During this period his health seemed pretty good, and the wound was dressed with poultices and mild stimulating ointments. Five or six days before he died, he was attacked with diarrhœa, which, however, was readily checked by chalk. This symptom was succeeded by constant sickness, the patient retaining little or nothing on his stomach, but no blood was passed either by the mouth or the rectum. He did not suffer from rigors, complained of no definite or local pain, and appeared quite conscious until May 9th, when he died, after having been comatose for some hours. Before death the edges of the wound in the neighbourhood of the elbow had somewhat healed, but nowhere else had this taken place.

At the post-mortem examination, there was found in the duodenum, about an inch from the pylorus, a circular ulcer of the size of a pea, extending only through the mucous membrane. The edges were clean, not elevated nor red. Brunner's glands were unaltered. The cerebral sinuses were filled with dark coagula of blood, which were adherent to their lining membrane. The rest of the body was healthy.

If suppuration occurs in a burn, great care must be taken to prevent contractions during and after cicatrization, for both granulations and newly-formed skin have such a tendency to shrink, that all the precautions which can be taken will sometimes prove abortive, and dreadful distortions result.

I cannot agree with Mr. Earle in considering them always a "source of blame to surgeons," but, on the contrary, believe that they are the effects of a condition of granulations and skin peculiar to burns, as, indeed, John Hunter has said:—"The contraction takes place in every point of the granulations, but principally from edge to edge, smaller and smaller, although there is little or no new skin formed, which now even has a similar power, assists the contraction of the granulations, and is generally more considerable than that of the granulations themselves; drawing the mouth of the wound together like a purse." These contractions produce most frightful scars and frequently interfere with the functions of important joints. I have often seen the chin drawn down upon the sternum, the lower jaw depressed so as to prevent the closing of the mouth, the saliva constantly flowing over the lips, deglutition obstructed, and all these inconveniences attended with frightful distortions of countenance. Permanent contractions of the limbs frequently result, tying the upper arm to the chest, after burns about the shoulders, so as entirely to prevent the performance of the motions of the upper extremity, rendering it often worse than useless, an actual burden, the inconvenience inducing the sufferer to seek any operation, even to the removal of the limb, for the cure of the deformity, rather than remain a permanent cripple. As to the operations proposed, and often performed, for the cure of the deformities arising from burns, I can say but little in their favour; and, indeed, so unsuccessful have they proved in my own practice, that I feel but little disposed to recommend a patient to submit to the painful dissections which are required for the removal of the cicatrices, and which so rarely afford the relief anticipated. Dupuytren, who does not speak very favourably of the result of operations on cicatrices after burns, recommends that they should never be attempted until months, or even years, after the formation of the cicatrix,—not, in fact, until the "fræna and bands had become perfectly organized," when he considers they have no longer any tendency to contract. An objection to the practice appears to me to present itself, viz. that the muscles have probably undergone a change to fit themselves to the new position of the limb; and that even bones themselves, if a joint be implicated in the contraction, may have also so far accommodated themselves to the circumstances in which they are placed as to be incapable of being restored to their original position.

The operation usually proposed for the removal of these deformities is, the transverse division of the contracted cicatrices until the parts can be drawn and extended to their natural position, and be retained by bandages and machinery competent to the purpose. In some cases this cannot be effected at once, but must be brought about by a slow and gradual extension, which should be constantly maintained during the granulating process. When these means are employed, the apparatus should be worn for many months after the wound is healed,—indeed, until the new skin has become perfectly organized, or contraction will be certain to recur as soon as the extending force is removed. Should the granulations become too exuberant during the recovery, nitrate of silver should be freely employed to keep them down. Some surgeons have recommended that the whole extent of the cicatrized skin should be dissected off, and that the parts previously bound down should be restored as nearly as they can be to their natural position, that the edges of the healthy skin should be brought into as close an approximation as possible, and appropriate means employed to promote the healing of the wound. Modifications of this mode of treatment have been adopted, by making a longitudinal incision through the healthy skin on each side of the wound, but at some distance from it, so as to allow the two portions of skin, thus let loose as it were, to be brought into close contact. Some surgeons have even practised the Taliacotian plan, of partially removing a portion of skin from the vicinity of the wound, attempting to restore the burnt surface by applying it over the wound, and to unite it, by what is termed the plastic mode; but, even under such circumstances, the contractions have returned with the same inveteracy as under the other modes of treatment.

I believe the great object is to prevent these contractions during the progress of the healing of the wound, and the position of the patient is the principal preventive means, taking care that the mechanical methods are persevered in until the cicatrix is perfectly organized, and the new skin has lost all its tendency to contraction; but I acknowledge it is very difficult to say when that exact period has arrived.

About three years ago I had under my care a child of eight years old, who had been burnt about two years before in the front part of the neck; and in consequence of the contraction of the cicatrix, the head was drawn down towards the chest, the lower jaw and lip depressed, and the countenance much disfigured. I made an incision along the base of the lower jaw as long as the cicatrix, and, dissecting the skin of the lip from the bone, restored it to its natural position. I then dissected off the whole of the cicatrix, divided the sternal attachment of the sterno-cleido mastoideus muscle on one side, and was then able to elevate the head; in which position I secured it by an apparatus which was made for the purpose, to support the chin, and prevent subsequent retraction. The plan promised complete success for six or eight weeks, but the pressure of the chin upon the instrument, probably from contraction recurring, became so painful that its use had to be discontinued,—the result of this was, that, although the patient was relieved, the deformity returned to a certain extent, and she left London permanently disfigured. One great advantage, however, was gained by this operation,—the lips were restored to perfect adaptation, and rendered capable of performing their natural function. I have also divided cicatrices from burns in the hands producing contractions of the fingers, but with no better success. The protracted period necessary to the cure tires most persons out long before it is completed; for the fact is, that a degree of tension must be maintained upon the new tissue forming the cicatrices for a sufficient period, not only mechanically to overcome the possibility of contraction, but at the same time to induce, from the continued stimulus of the tension, an action by which the character of the tissue appears to undergo a change by which that inherent tendency to contractility is destroyed.

LECTURE X.

SUPPURATION.

Suppuration—Its nature and causes—Source and formation of pus—Its period of commencement and duration—Description of pus—General and local symptoms of suppuration—Cold abscess—Suppuration of mucous membrane—Of cellular membrane—Of bone—Of arteries—Of veins—Danger of suddenly checking suppuration—Different methods of and precautions in opening abscesses—Psoas and lumbar abscesses—Their treatment.—Hectic fever—Its causes—Definition—Symptoms—Treatment.

I HAVE already stated that the different results of inflammation are resolution, adhesion, suppuration, ulceration, and mortification. Having considered resolution and adhesion, I shall now describe what is frequently termed suppurative inflammation.

In suppurative inflammation the exuded matter is formed into pus. The formation of pus may take place in an inflamed mucous surface, on the surface of an open wound, or in the interstices of a tissue. In the latter case, the pus collecting, forms an abscess.

Suppuration occurs in inflammations in which the adhesive process is opposed by loss of substance, or by some continued irritation from the presence of a foreign body, such as a piece of glass left in a wound, or by the constitution of the patient being at fault, his blood deficient in lymph, and therefore incapable of becoming organized into tissue. We often find this to be the case after amputations and other operations in persons of a strumous diathesis; therefore every surgeon studies well the constitutional powers of his patient before he subjects him to surgical operations.

The presence of pus is not, however, always to be considered as an unhealthy or undesirable condition, for it sometimes fulfils a most salutary office, as in granulating sores after gun-shot wounds, or extensive loss of substance from any other cause.

Pathologists have entertained different views respecting the formation or source of pus globules, as to whether pus is a new secretion, or merely altered colourless blood-corpuscles, or the debris of the inflamed tissues.

It is now known that pus does not exude from the capillaries in the form of pus globules, but that the latter are developed in the exuded matter, only after exudation. Suppuration on a mucous surface may be said to be a morbidly excessive development of epithelium from the morbidly excessive exudation caused by the inflammation, the cells of which, in the form of pus-corpuscles, are thrown off before being matured. Suppuration on the surface of an open wound may be viewed somewhat in the same light, the pus serving as an epithelium to protect the new tender granulations. The inner wall of an abscess, like the superficial part of an open wound, has been named pyogenic membrane, but the so-called pyogenic membrane is itself merely one part of the exuded matter metamorphosed;—in the latter case into granulations—in the former into a structure analogous to granulations; the other part of the exuded matter being transformed into pus.

The period at which suppuration takes place is very various, especially when it occurs in any other tissue than the mucous membrane. On the surface of a mucous membrane the elaboration of pus often occurs very rapidly, nearly as soon as the inflammation itself is set up. In gonorrhœa, purulent discharge is known to occur sometimes fourteen hours after infection, while, even in acute abscess, it takes several days for pus to be formed in the other tissues of the body, and under chronic inflammation it may be months before an abscess is developed. There are three causes for this diversity—namely, the texture of the part affected, the constitution of the patient, and the nature of the source of irritation. The duration of suppuration is also very various; it may last but a few hours, as when seated in the mucous membranes, or it may remain for months or even years, as sometimes happens in lumbar and psoas abscesses, and in fistulæ. This difference results from the same causes as those that modify the rapidity of the first formation of pus.

I have already alluded to the great tendency to purulent effusions, possessed by the mucous membranes. I will now direct attention to the protracted symptoms which result from the formation of matter in those tissues of the body which have less vital energy, and in which the premonitory, as well as the immediate symptoms are remarkably slow in their progress.

The influence of the constitution in modifying the formation of pus is well shown by the length of time during which the absorbent glands will remain in a state of inflammation in scrofulous patients before they suppurate, and the rapidity with which matter is formed under trivial exciting circumstances in irritable and sanguineous temperaments.

The nature of the injury, as well as that of the different kinds of disease, produces peculiarities with reference to the rapid or slow formation of matter; thus, an extraneous body, remaining as a source of irritation, soon leads to inflammation of the absorbents, and suppuration in the glands. Pus forms rapidly in phlebitis, while, in many diseases termed chronic, it is but slowly developed. The quantity of pus secreted also varies considerably, but appears rather to depend upon the constitution of the patient than upon the character of the inflammation.

I shall now describe the appearance and general physical characters of pus. It is a white creamy, emulsion-like liquid, composed of globules suspended in a fluid termed the liquor puris, its specific gravity is 1030, it putrifies with difficulty, and has an alkaline reaction, but soon becomes acid if left at rest exposed to the atmosphere. If pus be allowed to remain at rest for some time, the globules sink to the bottom, as they have a greater specific gravity than the fluid in which they were suspended. These globules, if examined under a microscope, are found to be between $\frac{1}{2000}$ and $\frac{1}{2500}$ of an inch in diameter, and to present a granular appearance. They are nucleated cells, but their nucleus is usually not evident until the pus has been acted on by much diluted acetic acid, when it is brought into view by the solution of the granules, usually in the shape of a multilobed body. Pus, at the moment of its issue from an abscess, is neutral; so is that which is obtained from the surface of a simple granulating wound; it is, however, sometimes slightly acid, which is said to depend upon the formation, under the influence of the air, of a small quantity of lactic and acetic acids. Pus may likewise become alkaline from the disengagement of ammonia; but in that case, a certain degree of putrefaction must have taken place.

As to the particular conditions which lead at one time to the development of new tissues from the exuded matter, and at another to the formation of pus, but little is understood. Much, however, depends on the quantity and quality of the exuded matter, and the place where it is deposited.

It has been supposed that an ulcerative process, or what may be termed an absorptive disintegration, occurs before matter is formed, or can be deposited; this hypothesis seems to have arisen from the idea of the necessity for a cavity being first formed to receive the pus, especially in deep-seated abscesses; but if we reflect that pus is merely developed from the exuded matter, no such preliminary action can be considered necessary, and certainly it does not take place on mucous surfaces, as suppuration will go on for weeks in ophthalmia and gonorrhœa without any loss of the substance of the affected membrane.

The constitutional symptoms pathognomonic of the formation of pus are so well marked as to render the diagnosis comparatively easy. Febrile symptoms generally result from the inflammation before matter is formed, and, indeed, frequently subside from the influence of remedies without the occurrence of suppuration, but if the irritative fever continues, and its violence remains unmitigated, resisting the usual means employed, there is reason to suspect the probability of suppuration, which will generally be soon determined by the premonitory symptom of rigors, the severity of which will depend upon the importance of the part affected, the inextensibility of the tissue inflamed, and the constitution of the patient. This rigor, the forerunner of the formation of pus, is, indeed, a remarkable phenomenon in the pathology of suppuration. It appears that, during its presence, the blood is driven from the surface of the body to the heart and large vessels, at which stage a sensation of cold is felt over the whole surface, sometimes even to "chattering of the teeth," as in ague; reaction then occurs as if the heart were suddenly stimulated, and the blood is sent with unusual force back to every part of the body, and more especially to the part affected.

This constitutes what is termed the hot fit, during which period the inflamed tissue rapidly advances towards abscess. The rigor may be perhaps considered so far a salutary condition, as it prepares the constitution, by a sudden suspension of all the functions, for making an effort to complete the object upon which it is employed. The sensation of cold, so frequently experienced by healthy persons after a hearty meal, is a somewhat analogous condition, when nature is especially preparing for the function of digestion.

If the tissue inflamed is such as admits of a ready formation of pus, as, for instance, the mucous membranes, neither rigors, nor any other indication of constitutional disturbance, will necessarily occur. The formation of pus in the cellular membranes is not usually accompanied by much irritative fever, or preceded by distinct rigors; these membranes are found to possess the power of rapid reparation; and it seems as if the constitution sympathised in proportion to the difficulty of the ultimate restoration of the affected structure.

When pus accumulates in a cavity formed in a tissue, an abscess is said to be formed.

Local signs also present themselves as pathognomonic indications of the formation of abscess. The patient experiences a change in the character of the pain, which becomes altered from an acute hot pain to a throbbing sensation, and a darker blush covers the surface of the diseased part. The swelling generally becomes circumscribed, and harder in its circumference than in its centre, where the skin is thinnish, and a fluctuation at this period may usually be detected. If the abscess be not now opened, an ulcerative process is set up towards the surface of the body, and the pus is spontaneously evacuated.

But, as I have remarked before, it is not always that such distinct symptoms mark the formation of pus, for under certain constitutional conditions, as, for instance, after protracted illness, scarlet fever, measles, and other exanthemata, it is not uncommon for abscesses to form one after another in different parts of the body; these are unattended by either the usual constitutional or local signs of suppuration: neither irritative fever nor rigor are present, there is no pain in the part, nor even redness, and yet large collections of pus are found. Chelius and other surgeons have termed this "cold abscess." It portrays, in fact, a general defect in nutrition, and deterioration of blood, and not a peculiarity either in the character of the inflammation or of the tissue affected. "Cold abscess" presents itself under the form of a softish tumour, circumscribed, indolent, and generally situated immediately under the skin, in which there is usually neither change of colour nor general appearance, at least, not in the early stages of the disorder. Fluctuation is more apparent in this than in ordinary abscess, because the pus is more superficial, and more liquid, and at the same time the sac is less distended. The pus discharged is generally of an unhealthy kind, thin, and often fœtid, and it continues to flow in large quantities. Colliquative sweats follow, and the patient soon sinks under the continued draining to which the system is subjected. In the post-mortem examination of these cases, the matter will frequently be found diffused over very large surfaces, and passing down even to the bones, which may be found denuded of periosteum, and would probably go on to exfoliation if the patient survived sufficiently long.

The character of the pus gives the best indication of the constitutional powers. If it be "pus laudable," that is of uniform consistence, of a yellowish white colour, and free from odour, the surgeon has confidence in his patient's recovery, and regulates his treatment accordingly. This renders it very important to examine carefully the contents of an abscess. Suppuration produces very various effects in the different tissues of the body, although all seem more or less obnoxious to its occurrence. Collections of pus may form in any tissue, it has even been found in clots of blood; it is met with at all depths, and in the bones themselves. It is, however, much more usual for it to be found nearer to the surface of the body. The mucous membranes are particularly subject to it, and the continuance of the process seems to be maintained in that tissue with the least degree of constitutional irritation or suffering.

Cellular membrane is also very prone to suppuration; and, in most cases of common abscess, the cellular tissue is the seat of its formation; hence, matter is frequently diffused over large surfaces, and leads to most mischievous results, by separating this universal connecting medium from important organs of the body, interfering therefore with their natural functions.

When matter forms in bone, considerable constitutional disturbance arises from the little extensibility of the tissue, but the presence of abscess in bone is denoted by very similar symptoms to those which occur on the formation of matter in the other structures of the body, such as rigors, and the peculiar throbbing pains, which are much increased at night. The soft parts become affected and ulcerate, from the continued pressure of the matter towards the surface; pus will indeed even pass through or dissolve bone to obtain means of exit. I advisedly use the term dissolve; for pus has the power of dissolving bone, and I believe I was the first to point out this fact. I was led to the consideration of the subject from testing some necrotic pus, which I found to contain a very large proportion of phosphate of lime, while healthy pus contains only a trace. I have lately applied dilute phosphoric acid to bone in a state of exfoliation and necrosis, with the result that dead portions have been thrown off, or I ought rather to say removed, with striking rapidity. This object has been attained by the phosphoric acid, converting the phosphate of lime into a biphosphate, in which atomic form it is rendered soluble, and is proportionably more readily removed. Necrotic pus itself affords an acid reaction. The treatment of abscess in bone is similar to that to which recourse is had when abscess is formed in other structures, and will be more particularly described when I treat especially of the diseases of the bones.

Fortunately, *arteries* under the influence of inflammation rarely suppurate; were they prone to this pathological condition, the application of a ligature would no longer be available as a remedy for aneurism: but in chronic abscesses it does sometimes occur that an artery will become opened by an ulcerative process, and therefore even in the simple operation of opening an abscess, it is necessary always to ascertain satisfactorily that there is no communication between the cavity of the abscess and the interior of an artery.

The *veins* seem more disposed than arteries to suppuration, and the constitutional effects produced when this occurs are always most alarming. The pathology of phlebitis will be more dwelt on when treating of the diseases of veins.

The pus exuded on the surface of a granulating sore is developed partly into new cellular tissues and capillaries, which compose the substance of the granulations, and partly into pus, which serves to protect the granulations.

Purulent discharge is sometimes useful in facilitating the escape of extraneous substances from the living body; it is assisted, however, by the process of ulceration, which is necessary to effect this object.

When the constitution of a patient has been for a long time subjected to the influence of a purulent discharge, as from a chronic abscess of the extended surface of an old ulcer, care should be taken not too quickly to check this habitual drain, or even if it should suddenly stop spontaneously, medicinal remedies, such as purgatives, sudorifics, &c., should be administered to obviate the danger arising from its suppression. Issues, setons, and blisters, are also had recourse to as the best prophylactic means which can be employed.

There are many opportunities of observing in the wards of hospitals, patients suffering from pains in the head, disturbance in the natural functions of the bowels, and other constitutional derangements resulting from the sudden healing up of large ulcers; these require purgative medicines for their relief. Many cases are on record of the relief of hæmoptysis by setons and issues, and of the return of the disease as soon as the artificial discharge had been checked.

An abscess differs only from suppuration of the surface, in the pus being confined, which leads to greater constitutional derangement than when it is freely discharged; either from mucous surfaces or from granulating sores.

In abscess there seems to be always a strong tendency to assume a globular form; this is, however, much modified when the abscess is formed in the neighbourhood of bone, or other strongly-resisting tissue. The pus in that case extends itself in layers. If, however, the secretion be abundant, aponeuroses, and even bones, are forced to give way; the tumour then becomes more and more regular, and reassumes the spherical form. It has been asked whether the destruction of the tissues is produced merely by the pressure of the accumulated pus, or whether some specific change be not at work in the character and constitution of those tissues; both these causes are, however, probably in operation. The cavity of an abscess is not always a free sac, but is sometimes traversed by bloodvessels, nerves, or even by excreting ducts. Whatever may be the situation of an abscess, it generally directs itself towards the surface. The mutual pressure between the viscera and the walls of the cavity, which is shown by the facility with which the former escape when those walls are accidentally wounded, is sufficient to prove that it would be difficult for pus to make its way into a serous cavity: although it is not common, it is, however, well known that such a result may occur, and that abscesses may burst and pour their contents into either of the great cavities.

If the secretion of pus continue in an abscess, it will spontaneously provide for its own evacuation, by making its way to the surface, either in consequence of its pressure upon surrounding parts, or from its irritating action upon them. Sometimes, however, it is advisable not to wait for nature to achieve the evacuation of the matter, but to effect the object artificially by opening the sac of the abscess, so allowing the pus to escape.

The period at which an abscess should be opened is an important subject for consideration: as a general rule, I should say it ought not to be until the local heat of the inflamed part begins to subside; for if it be opened before the time at which the abscess is "ripe," the action necessary to the formation of pus is interfered with, and an inflammation unfavourable to that action is liable to be produced. To bring about the condition most suitable to the evacuation of the contents of an abscess, poultices and fomentations are employed. This is a matter which will perhaps be considered as of very little importance, and somewhat beneath the dignity of a surgeon; but such is not the case, for there may be, I am almost inclined to say, scientific ability displayed, not only in the choice of the appropriate period for the application of a poultice, but also in the very mode of making it. Mr. Abernethy did not think it unworthy of himself to dwell upon this subject in his surgical lectures, and would often teach nurses how to make and apply a poultice. It should be made of stale bread, rasped to an impalpable powder in a basin; boiling water should then be poured upon it, a little sweet oil added, and the whole stirred up until it is worked into a smooth pulpy mass. The linseed meal which is generally used in hospitals contains mustard seed, and other irritating matters, which frequently do much harm.

As soon as there is evidence of suppuration having taken place, the earlier the pus is evacuated the better; unless perhaps we make an exception in the case of patients of a scrofulous diathesis, in whom I have generally found it better to leave nature to effect the evacuation of the matter in her own way, and to direct attention more particularly to the improvement of the constitution by internal remedies.

One great object with the surgeon should be to prevent unsightly cicatrices; and my experience leads me to believe that in strumous patients the scars are less when the abscess is left to open by ulceration than when the lancet is employed, unless the evacuation be effected by making three or four small punctures, afterwards applying gentle pressure to promote the escape of the pus.

I suppose there can be little doubt that pus is capable of being absorbed under certain circumstances; I do not mean as in phlebitis, taken up in the form of pus, but that the globules sometimes undergo disintegration, and are removed by the absorbent vessels; hence certain medicines are employed termed deobstruents, such as mercurial plaisters, iodine, &c.

When abscesses are to be opened, the object may be effected by caustic or seton, instead of the knife; but the latter mode is so far preferable that I shall say but little of the employment of the others, as from their protracted action they are liable to do considerable injury.

In cases of encysted tumours, in which, instead of pus, a kind of serous secretion is thrown out, corresponding to that which is sometimes called a "cold abscess," the set on may be desirable for the purpose of exciting a degree of inflammation sufficient to obliterate the cyst. I have successfully treated such cases by the introduction of a seton, but cannot think that this disease should be designated abscess.

The following cases may be regarded as instances of what is termed cold abscess resulting from a constitution in which the vital power was too low to form pus.

David Hughes, aged 20, a private in the Royal Horse Artillery, (from which corps he was discharged in consequence of the disease,) was admitted into Guy's Hospital on the 3rd of June, 1835. In appearance he was healthy, although of spare habit: twelve months before, his comrades told him that his neck was swollen, but he could not perceive it himself; a month after, however, he felt a swelling a little in front of the centre of the sterno-mastoid muscle:

it moved readily, and in deglutition was raised with the larynx. He was treated with leeches, and iodine both internally and externally; nevertheless, the tumour continued to grow until his admission into the hospital, when he was much emaciated. The tumour occupied the whole space between the sterno-mastoid and trapezius muscles, extending upwards as high as the mastoid process, and downwards as far as the junction of the middle with the scapular third of the clavicle, and horizontally from this point to the sterno-clavicular articulation. The lower and anterior part of the tumour was the most prominent, and of the most recent formation; the whole swelling seemed divided into three lobes, which did not communicate, though each fluctuated. From its size it pushed the larynx very much over to the right side; the integuments over it were of natural colour; it did not pulsate, nor did it appear to interfere with the circulation of blood in the neck; the patient experienced neither dysphagia nor dyspnœa.

On the 10th of June I made a small incision down to the sac at the most prominent point of the anterior cyst, and punctured it; about five ounces of serous fluid escaped, the first three clear, but the last two coloured with blood. I then introduced a long canula, furnished with a trocar, to which were attached four threads of silk, and pushing the trocar through the skin on the opposite side, passed a seton into the cyst; the tumour was then diminished about one-quarter, showing that only one cyst had been opened. I thought it best to wait the result of this operation before evacuating the other cysts. For the first two days the patient went on remarkably well, but on the third day after the operation he had considerable pain and swelling of the cervical glands and tonsils, with much constitutional irritation. There was an unhealthy discharge from the wound; he was ordered calomel and opium, effervescing draughts, and leeches, and the seton was removed.

He soon improved, and continued doing well till the 17th of June, when, the wound having ceased to discharge, a female catheter was introduced, and withdrew an ounce of sanguineous fluid; this was repeated twice or thrice. The tumour was now not more than one-quarter its original size, so that it appeared as if the other cysts had ulcerated through, and discharged their contents. He was ordered quinine and porter, and the tumour became gradually smaller, and in parts consolidated. On the 1st of July, I ordered it to be strapped with Empl. Ammon. c. Hyd., with the hope of entirely obliterating the cysts. This treatment was continued for a fortnight, and the tumour was reduced to about one-eighth its original size. On the 16th he was again attacked with cynanche, which was relieved in the same way as before. A week after this attack the tumour became considerably larger, and fluctuated posteriorly and inferiorly; an opening was therefore made, the other opening having closed. After this, he had another febrile attack, which left him much debilitated; but on the 3rd of August, scarcely any tumour was perceptible, no fluctuation could be felt, and there were distinct thickenings in the position of the cysts. From this period nothing untoward happened till the 11th of September, when a slight diffused inflammation appeared on the left side of the neck, which, however, yielded to mild sudorifics and salines. On the 1st of October, a portion of the tumour again filled, and three drachms of serum were evacuated by the lancet. The cyst soon however became obliterated, the opening healed, and after this he had no further relapse. He remained in the hospital till the beginning of November, when he was considered perfectly well.

I once admitted a patient into Guy's Hospital, sent up to me by Mr. Rump, of Holt, in Norfolk, who was the subject of a deep-seated tumour on the left side of the neck, causing difficulty in breathing and swallowing. From the manner in which it was tied down by the muscles, fluctuation was very indistinct, and I had the patient brought into the operating theatre, with the idea that I was about to remove a solid tumour. But in the progress of a careful dissection for its excision, the sac was opened, and several ounces of fluid escaped, this proving the true nature of the case. I introduced a portion of lint into the sac, which became obliterated, partly by adhesive inflammation, and partly by the process of granulation: the patient was discharged perfectly cured.

I believe the introduction of a seton is a better mode of treatment than injection in these cases, as it affords a more ready means of removing the source of irritation, and is less protracted than the employment of caustic for the purpose of producing obliteration.

When a knife, lancet, bistoury, or any cutting instrument, is employed for the purpose of opening an abscess, the most prominent point is selected, where the skin is the thinnest, and the fluctuation most distinct. I might dilate upon the manner in which the instrument is to be held, the kind of motion which is to be given to the fingers, and upon all the niceties of manipulation, but little would be learnt from my description; the modus operandi must be witnessed in the surgery and wards of the hospital: the only instruction I can give is, that a clean, sharp instrument should be used, and the operation performed with as much care as could possibly be devoted to one of higher surgical importance.

Great care should be taken in opening abscesses in the course of large arteries and nerves, which are liable to be displaced by the tumour; and when muscle covers an abscess, it is advisable to cut across the fibres of the muscle in evacuating the matter.

As the diffusion of pus causes inflammation, after matter has ceased to flow from the original opening, counter-openings should be made, to permit of the escape of matter which may subsequently have formed.

Abscesses in the situation of large arteries should be carefully examined before they are opened; for as aneurisms do not always pulsate, a mistake may arise, and profuse arterial hæmorrhage be the first indication that, instead of plunging his knife into an abscess, the surgeon had opened an aneurismal sac.

The fear of making an incision where there is a doubt whether pus be formed or not, is considered by some surgeons groundless, as they maintain that, at any rate, it will be of service to an inflamed part. I doubt this; for if the suppurative process has begun, without being completed, the incision will be hurtful, and interrupt nature's process.

Even when an abscess is situated in a region in which large arteries and nerves are placed, there need be no fear in opening it, if the precaution be taken of exposing the fascia, and then opening the abscess.

Some years since, a dresser of Sir Astley Cooper, in opening a bubo, not only let out matter, but air and fæces, and every one attributed to him the misfortune of having mistaken a hernia for an abscess. Sir Astley said, "Wait, gentlemen, before you condemn, for I believe the abscess will prove to be a fæcal one; and that the giving way of the bowel caused the abscess." The patient died; and Sir A. Cooper proved to be correct in his diagnosis.

There are various opinions as to the size of the opening to be made for the evacuation of an abscess: some surgeons recommend that it should be laid open along its whole extent, for the purpose of promoting the free escape of the fluid. Lisfranc recommended that the opening should be as small as possible, for nature always leaves a scar larger than the opening. I have, however, tried the small openings for the evacuation of abscesses, and found that they convert an abscess into a sinus, which continues indefinitely to discharge muco-purulent fluid, instead of pus. I usually take a medium course, and make an opening not more than three-quarters of an inch in length, which is quite sufficient for the free exit of the matter; and if judicious constitutional remedies be employed, the recurrence of the abscess may generally be prevented, as it more frequently depends upon the state of health of the patient, than upon local circumstances. In some cases it may be necessary subsequently to make a second and more extensive opening.

In large inguinal abscess, I have found Ricord's method of puncturing them in three or four different places, and then applying pressure over the emptied abscess, instead of evacuating the matter by one long opening, answer remarkably well; a long cicatrix is thus avoided, and at the same time the recovery of the patient is hastened.

Psoas and lumbar abscesses are the most difficult to treat; this difficulty arises from constitutional causes, more than from any topical peculiarities in the disease. These abscesses generally arise most insidiously, and attain a considerable size, without either pain or redness of the part, and little further inconvenience is experienced than an inability to active exertion. Sometimes, however, their formation is attended with pain in the loins, and in psoas abscess much inconvenience in extension of the trunk, which puts the psoas muscle on the stretch. The abscess sometimes forms above Poupart's ligament, but generally passes beneath it upon the thigh, requiring considerable knowledge and close investigation to distinguish it from hernia; in some circumstances it assimilates to that disease, not only in position, but also in some of the symptoms. Both psoas abscess and hernia dilate on coughing; both will sometimes return into the abdomen during the recumbent posture, and if there happen to be any derangement of the functions of the bowels concomitant with psoas abscess, there might arise great difficulty in distinguishing it from hernia; and I have seen patients wearing a truss upon a psoas abscess, owing to such a mistake. The history of the case, the appearance of the patient, and the strict examination of the swelling, must be the means employed for forming a just diagnosis of the two diseases.

Having discovered the presence of a psoas abscess, it is still a subject of great importance to ascertain whether the bones of the spine are diseased; and I know of no certain means of acquiring this knowledge, but by the analysis of the pus, to ascertain the presence of phosphate of lime. A difficulty arises, however, in the application of this test, since it is necessary that the abscess should be opened to obtain the pus; and I cannot call to my recollection a single instance of permanent recovery after a psoas abscess had been opened, when the spine was the seat of the disease; but lumbar and psoas abscesses may occur without the vertebræ being implicated. I have often seen patients admitted into the hospital with a small swelling upon the upper part of the thigh or loins, and nearly free from any constitutional derangement, scarcely suffering inconvenience, and perfectly unaware that their lives were in danger; yet few of them have long survived under the attacks of this disease. I scarcely know what treatment to recommend, but have followed a plan which, I regret to say, has in some respects proved as ineffectual as all others, although certainly it has tended to lengthen life beyond the period at which it would have terminated had the abscess been opened. My first object is always to improve the constitutional powers by nutritious food, porter, and strictly-enjoined rest; at the same time I administer tonic medicines, with iodine. The patient day after day considers himself improved in health, and says, that, although he suffered little before, he now finds, from the improvement he experiences, that he had been more unwell than he had himself thought. The dresser, perhaps, informs me that the abscess increases in size; I walk from the bed, or perhaps order cold to be applied to the swelling, hesitating as to what is best to be done, knowing that directly the abscess is opened, constitutional symptoms will set in, and from that moment the patient will begin to sink. I therefore always refrain from evacuating the abscess until the tumour on the thigh is shut out from the cavity of the abdomen by an adhesive inflammation; and this object I have attempted to effect in some cases by applying a little pressure, such as that produced by a weak truss, at the point of communication between the thigh and abdomen. The evidence of this object being attained is the impossibility of pressing the fluid into the abdomen, and the diminished impulse of the femoral tumour on coughing.

The pus is now to be let out, either by a free opening, or by small valvular openings, as recommended by Abernethy, so as only to evacuate a small quantity at a time: I really do not know how to advise, as the results have proved the same under both circumstances. From my experience, perhaps, I feel inclined to give the preference to the small valvular openings, as the shock is not so sudden or violent to the constitution. Whichever method is employed, I confess I entertain but little hope of the recovery of the patient. I regard these abscesses, when concomitant with disease of the vertebræ, as the highest degree of strumous development: and hectic fever, with all its horrors, generally completes the catastrophe.

When the suppuration has continued for a great length of time, hectic fever is almost certain to supervene, and may in fact be considered as the remote consequence of purulent discharge, just as irritative fever may be looked upon as the immediate effect of the formation of matter.

Hectic fever has been supposed to arise from the absorption of pus; but it rarely commences until an abscess has been opened and matter has continued to flow for some time, which would scarcely lead to the supposition that it was absorption of matter which induced the fever: indeed, it sometimes occurs before suppuration has commenced—as, for instance, when structures are affected which possess but little vitality; such as large joints, and more especially the knee or hip. Hunter says, "hectic fever depends upon the disease of a part beyond its powers of acting for its restoration, and beyond the powers of the constitution to overcome the disease. So it may be said collapse, after a severe injury, is beyond the constitutional powers of restoration. Whatever will long and obstinately tease the constitution, may become the cause of hectic." The constitutions most obnoxious to hectic are the weak and irritable; and, indeed, sometimes hectic symptoms commence in such persons as if idiopathically or proceeding from some very slight source of irritation, even during the healing of a sore in which there seems to be no impediment to recovery.

Hunter has described the symptoms of hectic fever in the following words:—"A kind of slow dissolution of animal life; a general slow fever, with great debility, irritability, languor, want of appetite, paleness of the skin, sweats easily provoked, and frequently arising spontaneously, sometimes attended with vomiting and purging, but with the secretion of a clear urine." In fact, he seems to regard it rather as a constitutional disorder, than one arising from any peculiar source of irritation, although it must be acknowledged that it generally results from protracted suppuration, or that it occurs in the commencement of the formation of abscess in constitutions already enfeebled by prior disease.

Hectic fever is often attended with a distinct cold and hot fit, resembling ague, but is not, like intermittent fever, regular as to the periods of accession, although the exacerbations are usually in the evening; it may be distinguished from ague by the irregularity of the cold and hot stages, and by their duration. The usual form of hectic may be recognised by the tendency to chilliness of an evening, followed by a hot skin and sensation of burning of the palms of the hands and soles of the feet, rapid pulse, great thirst, and a circumscribed flush on one or both cheeks. The patient continues restless, often sleepless, during the night, and towards morning a copious, although perhaps a partial, perspiration carries off the fever, and leaves him pale and languid, but nevertheless with an accelerated pulse. Each successive attack renders him weaker than before; the slightest excitement, as that produced by any one approaching his bed, brings a flush upon his countenance and dampness upon his skin: the eye has a glassy brightness, sudden paleness succeeds the momentary blush, the voice is scarcely audible, the lips are dry and red, the tongue clean, but unnaturally polished, and sometimes aphthous sores are found upon its edges. If these symptoms continue unrelieved, the destruction of life is soon accomplished, and the patient dies from complete exhaustion.

The administration of internal remedies for the cure of hectic fever must be directed to the intention of strengthening the constitution, and enabling it to support the irritation to which it is subjected; under certain circumstances they may also be intended to induce an altered and improved action in the diseased structures.

When the patient is so weak and irritable that all hope of improving his condition is passed, while the source of the constitutional disturbance remains, its removal, if admissible, should be had recourse to; and, even after aggravated hectic symptoms had supervened, I have frequently seen patients rapidly recover on the amputation of suppurating joints, and the removal of other causes of that disorder. Generally it must be considered, however, that the best period for surgical operations is past when hectic symptoms have supervened; and therefore surgeons usually remove the source of constitutional derangement, when such a course appears advisable, before hectic is established.

In the treatment of weak and irritable patients constitutionally prone to hectic fever, great care must be taken not to lower their powers, even in the local depletions which may be necessary in the case of external lesion.

General blood-letting, under any circumstances, can scarcely be admissible; but, if blood must be abstracted, it should be by the application of leeches, or by cupping on the part affected.

Even purging must be cautiously had recourse to, as it often tends very much to lower the powers of the patient, and to render him highly irritable; therefore nothing beyond merely maintaining the natural alvine excretions should be desired. I have often seen patients as long in recovering from the prostration produced by an over-dose of cathartic medicine, as from the abstraction of a large quantity of blood.

If hectic symptoms have not commenced, sudorifics will be found highly beneficial in the case of irritable patients, as they do not tend to lessen their strength to the same degree as purgatives, and yet, at the same time, they diminish action and maintain the natural state of the secretions.

Opiates are highly essential, and are frequently available, not merely for allaying the irritability of the patient, but often for diminishing at the same time the local disease; and I have frequently witnessed in their operation an excellent example of the reciprocal influence of action and reaction.

Topical remedies may also assist much in subduing the irritation arising from a local defect; hence the frequent employment of lotions for the purpose of lessening the action, either by cold or some other sedative property. Evaporating lotions are useful for the first indication, and preparations of lead for the second. Poultices, fomentations, blisters, and setons, may each in their turn be useful in certain conditions of local disease; but no general rule can be given by which to decide as to the fittest application: that knowledge is to be acquired only by a comprehensive view of the violence of the action and the nature of the part affected, as well as of the constitutional ability of the patient to support the effects of the means which may be employed.

I would earnestly caution you, gentlemen, against the error of mistaking irritability for increased action and power, and so being induced to deplete when the soothing plan alone should be adopted. Let the cause of the constitutional derangement be sought for, and it will often be found that the evacuation of a small quantity of matter confined by some inextensible structure will remove at once all the alarming symptoms which have resulted solely from its presence. This distinction between irritation arising from a local cause, and that from an idiopathic tendency, is especially the province of the surgeon; and the readiness with which he recognises the difference, and discovers the "error loci," distinguishes him as conversant with one of the most important points in his profession. I have often witnessed these constitutional effects after surgical operations, and especially after the operation of lithotomy; one illustration will be sufficient as a type of all such occurrences. After a patient has been submitted to the operation, and some hours have elapsed, and he has recovered from the shock, he may suddenly be seized with a violent rigor, which would lead to a supposition of its being premonitory of the formation of matter. The rigor will continue for some time, when suddenly a contraction of the bladder is felt, a large clot of blood is expelled, and the rigor immediately ceases. Being now perfectly aware of this frequent result from bleeding into the bladder, I always forewarn the attendants of the probability of the occurrence of the symptom, and so prevent alarm either to the patient or to those around him.

LECTURE XI.

ULCERATION.

Hunter's Definition—Description and uses of the absorbent vessels—Three kinds of absorption: Ulcerative—Progressive—Disjunctive—Description, causes, and treatment of the two first—Granulation—Cicatrization—Characters of healthy and unhealthy granulations—Objects of suppuration—Ulcers—Their causes—Description and treatment of different kinds of ulcers—Healthy—Exuberantly granulating—Indolent—(Dr. Bird's galvanic apparatus.)

Ulceration, or ulcerative inflammation, as it was termed by John Hunter, is another phenomenon, depending upon an altered action in the capillaries of a tissue, and resulting from inflammation. Sir Astley Cooper defined ulceration to be "an absorption of any constituent part of the body, when resulting from diseased action;" while, again, there are others who look upon ulceration as a molecular death of the inflamed tissue, and thus consider it as identical with mortification.

I am of opinion, however, that there are distinct phenomena connected with ulceration, which render this process different from mortification, viz., that the constituents of the affected part undergo the slow process of disintegration, or if I may use the term, proximate decomposition, before they can be taken up by the absorbents. Indeed, in my own mind, I am inclined to believe that some degree of parallelism may be traced in the removal of a part by ulceration, and in the change which all ingesta undergo before they can be converted into chyle, and taken up by the lacteals; for in ulceration there is invariably found an effused fluid which seems to have the power of holding the constituents of the inflamed tissue in solution, so that it may be taken up by the absorbents. This, however, is doubted by some pathologists, and especially by those who appeal to the results of microscopical research: they maintain that in ulceration, the parts which disappear are thrown off in minute sloughs, with the discharge constituting what they term a minute process of mortification. It appears to me, however, that ulceration and mortification differ from each other in these respects. In ulceration the proximate elements of the tissues seem to undergo a process of separation from each other, before they can be removed by absorptive action; a change indeed which I have previously attempted to express by the term, proximate decomposition,—a process which can only take place during the life of the tissue, and which must, in my opinion, necessarily precede its removal by the absorbents: while, on the contrary, death precedes decomposition in gangrene; the latter change arising only from the chemical action to which all dead matter is liable, and the resulting products of which are capable of poisoning the blood, and producing violent constitutional irritation. This circumstance proves that the matters resulting from such chemical change are totally incapable of being converted to further use in the animal economy.

Again, in mortification of a limb, the point of separation between the living and the dead matter, technically termed the line of demarcation, is a good example of ulceration; which, if left to itself, would be competent to effect the complete separation of a dead part, even through the bone itself. This is, I think, a strong instance of what I wish to maintain, that an action is set up whereby the tissues between the living and the dead parts are brought into a state in which they can become absorbed, and are consequently perfectly removed; destroying the union between the living and dead tissues, and leaving the surface of the living part to perform the office of reparation.

Ulceration may arise from the inability of parts to support their vital action under certain diseased conditions, and, according to John Hunter, may accrue either from some source of irritation set up, or from a weakness depending on defective nutrition.

There are various circumstances which may give rise to ulceration, and which may depend upon constitutional or local causes. It is generally very difficult to ascertain whether the morbid action commences in the blood, bloodvessels, or tissues. We frequently see, for instance, small ulcers, especially in the lower extremities, occur without any obvious cause, even without premonitory symptoms. It can scarcely be believed that such a local lesion should result from deterioration of the general mass of blood without any constitutional disturbance, or without even the vessels of the part affected being primarily disordered. It is therefore probable that, under these circumstances, some slight morbid change in the tissue itself leads to the inflammatory condition, from which ulceration ultimately results.

In the case of syphilitic inoculation, leading to the formation of chancre, the syphilitic virus is the source of irritation, and invariably leads to inflammation and ulceration. Pressure also, when applied externally, that is to say, upon the surface, leads to ulceration, if it act with sufficient force to diminish the circulation of the part, but if it be applied with a less force, it, on the contrary, produces a thickening.

Weakness, or a want of power in a part to maintain its natural condition and functions, may give rise to ulceration. Of this we have examples in the facility with which cicatrices (compared with originally formed parts), ulcerate from slight exciting causes. Surgeons lance the gums of children long before the teeth have approached the surface, because they are aware that the cicatrix will be much more readily removed under the pressure of the tooth than the originally-formed gum. From the same vital conditions, old united fractures will become disunited if subjected to continued irritation, or from being deprived of their necessary nutrition. Frequent instances of this kind occurred among the sailors who accompanied Lord Anson in his voyage round the world; for many who were attacked with scurvy suffered from the disunion of old fractures, and the ulceration of cicatrices. This phenomenon results probably from the facility with which the newly formed parts are capable of being resolved into their proximate elements; but whether this depends upon a defect in physical cohesion, chemical combination, or want of vital power to resist morbid action, is yet unknown to the pathologist.

A further proof of the influence that debility possesses in promoting ulceration, or, perhaps, I ought rather to say, the feebleness of its power to resist it, is, that the parts most distant from the heart are more prone to ulceration than in proximity to that organ.

When ulceration goes on very rapidly it is distinguished as acute ulceration, and may be attended with severe pain and a considerable degree of irritative fever. Generally, however, neither pain nor fever are prominent features of the disease, not even when its progress is most rapid. Indeed, ulceration seems to have but little effect upon the constitution, although the constitution powerfully affects ulceration. The character of the pain, when it occurs, is also peculiar, being generally described as a gnawing sensation, the intensity of which depends upon the irritability of the patient. Opium is indicated in large doses when this symptom is present. Indeed, I principally depend upon opium, administered internally and applied topically, as the remedy to check ulceration; if this remedy fails to produce the desired effect, I apply either strong nitric acid or lunar caustic to the ulcer, especially if its surface be very painful, as those agents destroy the sentient extremities of the exposed nerves, and not only immediately diminish the pain, but, at the same time, lessen the irritability of the sore, which is probably the principal cause of their inducing a healthy action. So that perhaps it may be said that opium and escharotics are applied in these cases upon precisely the same principle. Iodide of potassium, mineral acids, bark, and other remedies, may also be required in protracted cases to uphold the constitutional powers during the progress of the cure.

Progressive absorption.—Surgeons speak of this as a kind of ulceration, but it is different from the process described above: it is truly a process of absorption. The best example which I can give of this kind of absorption is, the slow removal of parts subjected to an internal pressure, as from the growth of an aneurismal tumour slowly eating its way through all obstructions as it progresses towards the surface. There is no provision of nature more wonderful than this tendency of absorption towards the skin; for, although a large internal tumour may be in contact with the surrounding viscera, and pressing equally in every direction, absorption will only occur towards the exterior of the body, and, indeed, thickening of the structures in contact with the growing mass will take place in every other direction, so as to prevent it extending itself inwards. This kind of absorption is called "interstitial," and is not attended with suppuration when acting on bones. We have a proof of this, not only in the absorption of the spine and ribs from the pressure of an aneurismal sac, but also in the absorption of the alveolar process after the extraction of a tooth, and the spontaneous removal of small exostoses.

Disjunctive absorption is intended to denote the process set up for the separation of a dead from a living part, constituting that particular barrier between them which is termed "the line of demarcation." I shall describe this phenomenon when I arrive at the subject of mortification.

Suppuration usually attends ulceration, to a greater or less extent; but the pus is imperfectly formed.

All structures are not equally susceptible of ulceration. Tissues possessing but little vitality—an inferior degree of organization—ulcerate with considerable difficulty; as tendon, fascia, bone, and cuticle.

An important surgical point is connected with the fact, that tendon, fascia, &c., are not readily removed by absorption, or destroyed by ulceration; when any of these tissues form the parietes of an abscess, they should be early opened, so as to let out the matter, for its liberation by the process of ulceration would be tedious, and the constitutional disturbance proportionably severe.

As ulceration leads to the solution of continuity of parts naturally united, it may be inferred that the reunion must be effected by some healing process, and this is termed

GRANULATION.

When solution of continuity has occurred from ulceration or loss of substance by an incised wound, so that the edges cannot be brought together,—when a large cavity is left after the evacuation of pus from an abscess, or extensive surfaces are exposed, from which sloughs have been separated, they must all heal by granulation.

With a little consideration it will be perceived that there is not the wide difference between the process of union by adhesion or by the first intention, and that by granulation or by the second intention, which might at first be supposed. In the former, *all* the exuded matter is forthwith converted into tissues; whilst in the latter, the exuded matter is developed, partly into the tissues which form the granulations, and partly into pus. Perhaps the greatest distinction between Nature's first intention and her second, or granulation, is, that the latter is accompanied by suppuration, while the former is not. Granulations, as already said, are formed by the organization of the lymph effused from the surface of the ulcer. These newly-formed granulations in their turn throw out a fresh layer of adhesive matter, and thus layer after layer of granulations is produced, until they fill up the cavity to be healed. Such a surface is usually called an ulcer, but it is not intended to imply by that term that ulceration is still going on; for, on the contrary, this condition indicates a reparative action, and, perhaps, a part in such a state would be better termed a "granulating sore." Still, however, ulceration is not always to be considered as an unhealthy action; for when induced by the irritation of dead bone, or any other extraneous body, the loss of substance has to be restored by granulation, as when the solution of continuity arises from idiopathic ulceration. Healthy granulations have a natural tendency to contract, and thus diminish the superficies as well as the depth of the wound. The granulations are, at this period of the process of healing, so closely united, and their capillaries inosculate so freely, that any attempt to separate them immediately produces hæmorrhage.

To complete the cure which has proceeded thus far, it is necessary that the granulations should be covered with skin, and this is effected partly by an elongation of the original skin, and partly by the formation of new. The original skin is stretched by the contractions of the granulations, and drawn nearer to the centre of the sore, and not unnaturally, because previously, while the ulcerative process was going on, it had receded, in consequence of its elasticity. Its capillaries inosculate with those of the other tissues which had supplied the granulations, and new skin becomes formed, cutis and cuticle together; and when they completely cover the granulating surface, cicatrization is said to be completed.

It will be observed, therefore, that cicatrization depends, in great measure, upon the shrinking of the granulations, so that any circumstance which tends to prevent this impedes the process of healing. This often happens when sores are situated near the surface of bones, as on the head, and fore part of the legs, in which situations there will frequently be seen very extensive cicatrices, from the quantity of new skin required to fill up the abraded surface, and the slight power of its approximation, in consequence of its inextensibility in those situations. In cicatrices of this kind, the new skin always appears as if put upon the stretch to cover the wound, and the old skin seems puckered as if by the drawing up of the new; by use, however, it soon becomes loose and flexible. Under all circumstances, the formation of a new skin is a process performed with difficulty; and this fact should be borne in mind by every surgeon, in order that, during the performance of an operation, he may be sure to leave plenty of old skin to cover the factitious wound.

The healthy state of the granulations may be readily judged of by their appearance—a circumstance well worthy of attention, as by a just appreciation of their condition the surgeon is enabled to judge, in great measure, of the constitutional powers of his patient, and to regulate his internal remedies and topical applications accordingly.

When granulations are in a highly reparative condition, they appear as small conical projections, of a bright red colour, which is owing partly to the great quantity of blood sent to them, and partly to the proximity of the blood to the air, from which it appears to undergo a sort of aëration. But when the surfaces of the granulations are pale, or approach to a livid colour, it will be found that the healing of the wound is protracted, and generally some constitutional derangement will be observed.

Granulations, however, differ somewhat in appearance, according to the peculiar tissues whence they originate, although they are not always ultimately convertible into that tissue from which they receive their blood. Thus, we find, in the reunion of a muscle by granulation, that the newly-formed connecting medium never possesses irritability; that is, the power of contraction upon the application of a stimulus. Even in the reunion of ruptured tendons and ligaments, it requires a considerable length of time before the newly-formed structures attain the inextensibility of the original tissue, and lose an elasticity which interferes with the natural function of the part.

There is reason to believe the capillaries of synovial membranes are not capable of restoring the lost tissue; for, although there may be occasionally found adventitious sacs containing a fluid resembling synovia, the identity of the two is very doubtful; and in dislocations, where a supplementary joint is formed, no new synovial capsule is generated, but the head of the dislocated bone becomes eburnated, and so friction is diminished; but there is no synovia secreted unless some of the old capsule is left entire.

The pus which covers the surface of the granulations of a healthy sore not only performs the useful office above alluded to, of forming a coating of moisture, at the same time defending the newly-formed tender structure from the deteriorating influence of external agents, but it also prevents the absorption of injurious matters; for there can be no doubt that even miasmata may affect unhealthy granulating surfaces; and there is every reason to believe that hospital gangrene and other specific actions are induced in sores through the absorbent powers of granulating surfaces.

The influence of medicinal applications on the constitution, when employed on ulcers, is an every-day occurrence; and patients will frequently be seen as powerfully affected by mercurial and opiate dressings applied to sores, as if those remedies had been administered internally.

As the process of granulation for the cure of wounds does not invariably proceed in a healthy manner, it becomes necessary that I should explain the different kinds of granulating sores which come under the notice of the surgeon in the category of ulcers; and, at the same time, I shall endeavour to point out the various constitutional and local influences which lead to the particular aspects they present, and the appropriate remedies which should be employed for their amelioration.

ULCERS, OR GRANULATING SORES.

There is considerable difficulty in defining and classifying ulcers so as to furnish a ready or scientific method by which we may be enabled to judge of the true nature of this disease. It is not etiology alone which will teach all that is required, nor will the situation or form of the ulcers, or even the nature of the discharge, afford sufficient knowledge for the appropriate treatment of every variety of sore. The cause which originally produced the ulcer may be long removed, and the defect in reparation be depending on something quite different from that which first induced the solution of continuity.

It seems, however, philosophical in the first instance to look for the cause; but it must be borne in mind, that, whatever may have led to the ulceration, the constitution, the situation, the form of the sore, and the tissue affected, may tend to particular modifications, and require a direct application of means to remedy any baneful effects they may have induced on the ulcer.

I think it may simplify the matter if we commence by the consideration of the various kinds of sores etiologically, dividing their causes into

- External or Local,
  - Mechanical,
  - Chemical.
- Internal or Constitutional,
  - General,
  - Local,
  - Combined.

But even with this view, there may be some pathologists who regard the proximate cause of all ulcers as internal, as ulceration must be considered a vital process which operates from within even in cases where the remote cause—the application of an irritant from without—first excites the local action; as, for instance, in the inoculation of syphilitic virus.

The lower extremities are much more subject to ulceration than any other parts of the body: this results from their greater distance from the action of the heart, and also from the liability to retardation in the natural circulation of blood through their veins; from which cause also we find it frequently so difficult to heal ulcers on these portions of the body.

An ulcer is termed *healthy* (if such a term may be admitted) when it is filled up by small distinct red granulations, equal in size, and presenting elevated pointed apices, which are bedewed, rather than covered, by pure pus. If the pus, however, be rubbed off, the surface of the granulations will not be exposed, but will be found to be covered with a thin layer of plasma, not yet become vascular, and this may be demonstrated by applying a little alcohol to the surface after the pus has been removed: the alcohol immediately coagulates the plasma, renders it opaque, and conceals from view the vascularity of the granulations, which was before perfectly apparent.

Such a granulating sore usually requires but little assistance from the science of surgery to insure its healing; rest only is necessary, with due attention to the natural secretions.

Should there be an indisposition in the sore to cicatrize, it will often be found very useful to give gentle support to the granulations; for it is to be borne in mind that newly-formed granulations are not endowed with the same power as originally-formed parts; and, therefore, they should be carefully protected from external injury; at the same time, benefit is frequently derived from pressing the edges of the ulcer towards each other with strips of plaister, which not only tends to diminish the extent of surface to be filled up by the granulations, but also prevents their being constantly dragged upon and separated from each other by the elasticity of the skin.

Although the sore just described as a healthy ulcer principally belongs to those kinds which are termed local, it may also have originally commenced from a constitutional or even a specific cause; for, if remedies be given which improve the health of the patient, or destroy the specific action, any kind of sore may then put on the character of a healthy wound, into which it has, in fact, become converted by the altered state of the constitution.

So, on the other hand, an ulcer which had been for a length of time healthy, may suddenly put on a most unhealthy character, from some constitutional deterioration. This fact may be often observed in the hospitals, and it more frequently occurs in patients who have come up from the country, and who get out of health from the confinement and comparatively impure air of London.

One of the most frequent changes ulcers undergo, is readily distinguished by the elevation of the granulations above the level of the surface of the skin, resulting from an exuberant growth of the granulations, and producing that appearance which in common language is termed "proud flesh."

Exuberant granulations.—In such cases pressure is indicated; it is best effected by the application of bandages; but, should such means not succeed, escharotics may be required to keep down the tendency to hypertrophy. Sulphate of copper I consider the best application for this purpose. Nitrate of silver, which is very frequently employed, tends, in my opinion, rather to increase their growth; for although, when first applied, it removes them, yet they appear to return with increased vigour after its escharotic influence has ceased. A low diet is also sometimes indicated when the granulations show this disposition to hypertrophy. It is quite essential that the granulations should be brought down to a level with the skin, else cicatrization cannot take place. These exuberant granulations do not necessarily indicate local vigour or constitutional power in the patient: they occasionally appear rather to arise from a want of ability in the skin to cicatrize over them, and thus naturally check their growth. They indeed frequently occur in debilitated persons, and are perhaps most conspicuous in those ulcers which are kept open for the discharge of carious bone, where, for obvious reasons, cicatrization does not occur, and therefore granulation goes on to exuberance. The cure of these ulcers, under such circumstances, is of course the removal of the mechanical irritant.

Indolent ulcers, whether arising from an external cause or from constitutional derangement, are characterized by their granulations being broad, pale, and flabby, instead of small, red, and firm, as in a healthy condition of sore. This state shows that the granulations are too weak to supply organizable plasma, or, in other words, to heal. It becomes, therefore, necessary to ascertain whether this defect originates locally or constitutionally, and to treat it accordingly. It will usually be found that such remedies are required as should influence both the general powers of the patient, and act upon the ulcer itself; for, whether the constitution or tissue were first affected, no diseased action can be maintained for any length of time in either, without a reciprocal action being established; and, therefore, both require treatment.

In such cases bark and acids are indicated, having taken care first that the bowels are freely opened, and the secretions generally natural. Stimulants should be applied to the ulcer, either the Ung. Nitrici Oxidi, or the Ung. Zinci; or, should lotions be preferred,—and, indeed, in some cases they seem more suitable than greasy applications,—nitric-acid lotion, or zinc and lead in solution, may be substituted; but, at the same time, the patient should be kept during a large portion of the day in a recumbent posture, and much benefit is sometimes derived from the elevation of the affected limb. Porter and generous diet will also expedite the cure, by exciting the reparative process. The pressure and support of a bandage is occasionally useful, but in languid or indolent ulcers its utility is doubtful; for I have frequently observed that a tendency to slough follows its application, as if the granulations were too tender to sustain the slightest pressure.

When these ulcers prove very stubborn, and resist all constitutional and topical remedies, I have lately witnessed the best results from stimulating their surface, by subjecting it to a stream of negative electricity by a method I shall describe, and which was recommended by my colleague Dr. Golding Bird.

At a convenient distance from the indolent ulcer (not less than five or six inches) a portion of cuticle is raised from the cutis by the application of a small blister of the size of a half-crown. The cuticle is removed by a pair of scissors, and on the exposed cutis a piece of zinc-foil is placed, of the same size as the denuded spot. A plate of silver-foil is laid on the original ulcer, and the two plates connected by means of a thin copper wire. The size of the silver plate is immaterial. Both zinc and silver are now covered with pieces of moistened lint and oil-skin, and the apparatus, as recommended by Dr. Bird, is complete. In a few hours the surface beneath the zinc becomes white, and a slough begins to form, which in a short time is thrown off, leaving a healthy ulcer behind. In the meanwhile a great change has taken place in the original ulcer: it has thrown aside its indolence; the granulations are sprouting and contracting; new skin is forming at the margin, and the whole surface looks healthy and animated. The rationale of the action of this contrivance is simple enough. There occurs a decomposition of the water and chloride of sodium naturally existing in the blood and tissues; the result of this is the formation of soda (oxide of sodium) and the evolution of hydrogen and chlorine. The former escapes at the silver plate, while the latter unites with the zinc to form chloride of zinc, which produces the above speedy escharotic effect.

LECTURE XII.

Ulcers (continued)—*Callous*—*Inflamed*—*Sloughing*—*Irritable*—*Sinuous*—*Fissure*—*Varicose ulcer* (*case*)—*Menstrual ulcer*—*General laws of treatment*—*In-growing of the nails of the fingers and toes.*

Callous ulcer.—It is not unfrequent for an indolent, to become converted into what has been termed a callous ulcer. The edges of this kind of ulcer are surrounded by a white, dry, insensible, elevated substance, which sometimes acquires a very considerable thickness, and even spreads over the surface of the sore.

This peculiar character of the sore seems to depend on an atonic state of the skin, which tissue is more at fault than the granulations; and we frequently find it in cases of old cicatrices, which being naturally of low vitality, readily ulcerate, and with great difficulty heal again. Such callous sores are most prone to form in old persons, or in those of weak constitutional powers. The best topical treatment is to soften their hardened edges by poultice, to scrape them off with a spatula, and to apply zinc ointment to the exposed cutis, as this indurated growth seems to be little else than morbid cuticle. Blistering or lunar caustic may be required if the zinc proves ineffectual. The constitutional treatment need differ in no respect from that laid down for the cure of indolent ulcers.

The inflamed ulcer.—This kind of ulcer results generally from the patients having continued their usual avocations from the first commencement of the sore up to the period when compelled to seek medical relief; and it is surprising to watch the beneficial change produced by one day's rest, cleanliness, and the effects of a purgative. Frequently, on the day following the admission of such patients, I have wondered how I could have admitted so unimportant a case, scarcely recognising the ulcer I had seen only twenty-four hours before.

The granulations of such ulcers are usually below the level of the skin; they run into one another, and have a great tendency to bleed; the discharge from them is sanious, serum mixed with red particles, and they are generally surrounded by a kind of areola of inflamed skin, but, at the same time, they are not particularly sensitive, and their granulations easily slough.

Now this condition, if it depends on constitutional causes, does not yield so readily as I have just described, where the state is referable wholly to local causes, and it is only to be determined by a strict investigation into the history of the case, whether we are to depend most upon constitutional or topical remedies.

It will always be safe to confine a patient to his bed who is the subject of an inflamed ulcer; for, by the recumbent posture, the affected limb being at the same time kept elevated, congestion of the vessels of the granulating surface will be relieved. Purgative medicines should next be administered, and continued so long as any general plethoric tendency is indicated.

If the local inflammation be great, a few leeches may be applied around the wound; or, what is still preferable, if there be any enlarged veins which promise a supply of blood, they may be opened, and blood may be in that manner abstracted with less danger of consequent irritation. This practice should be adopted more especially when there is reason to fear an attack of erysipelas.

Having by this treatment sufficiently depleted the patient, restored the secretions, and removed the congestion of the vessels of the ulcer, it may be right to alter the plan entirely, and to support the constitutional powers of the patient.

It is therefore not to be considered as an incompatible system of treatment, because leeches and purgatives are ordered one day, and bark and wine the next; for this is a proceeding very frequently required when the inflamed sore originates in a local cause, and the constitutional disturbance is a consequence. Tepid poultices, mixed with a weak solution of the diacetate of lead, are the best local applications.

The most decisive indication of a favourable result from these remedies is the growth of the granulations, the formation of healthy pus, and the restoration of the surrounding skin to its natural colour and temperature. These changes accomplished, the ulcer may be regarded as a healthy sore, and will heal readily with little further care beyond that which is necessary to maintain the health of the patient.

Sloughing or gangrenous ulcer.—If we fail in relieving the inflammation of an inflamed ulcer, and the intensity of the local action continues beyond that which the vitality of the granulations can support, the character of the ulcer becomes completely changed; the granulations lose their redness and pyramidal shape; the surface of the sore no longer emits any discharge, but assumes an ashy grey colour, and small vesicles form around the wound. Concomitant with these appearances there is usually some irritative fever, of more or less asthenic character, depending on the peculiar constitution of the patient.

The local treatment must be gently stimulating, and nitric acid lotion seems to be the best application (a drachm of the diluted acid to a pint of distilled water is the requisite strength). Stale beer-grounds poultice, or port-wine poultices, are often employed with great benefit. Mr. Martineau, of Norwich, used to order in such cases a poultice composed of equal parts of bread-crumbs, powdered bark, chalk, and charcoal, and I have certainly witnessed a rapid separation of the slough, quickly followed by a growth of healthy granulations, after its employment. I suppose that it acts by absorbing the irritating ichorous discharge which is emitted from the sore. The solution of the chloride of lime in water is a most excellent application to grangrenous sores, the strength of the solution being of course regulated by the peculiar condition of the sore: the local applications, whatever they may be, must be employed for the purpose of promoting the separation of the gangrenous part by stimulating the subjacent granulations; but at the same time I am disposed to believe that much more reliance is to be placed upon constitutional than local treatment; constitutional remedies will therefore be required, as well as the topical means already described. Bark and the mineral acids, with wine and porter, will be found highly beneficial; at the same time paying due attention to the state of the secretions, more especially the alvine; for, although the constitutional powers require maintaining, free evacuation of the bowels is a most essential consideration.

Irritable ulcer is distinguished principally by the high degree of sensibility of the granulations. This sensibility may either arise from constitutional excitement or merely from the exposure of the sentient extremities of the nerves of the ulcerated parts. The granulations of these sores are unequal, both in respect to their size and degree of vascularity—sometimes pale, flabby, and exuberant; at others, hyperæmiated, and very liable to bleed,—and the pus secreted is generally mixed with the red particles of the blood.

When the sensitiveness of the ulcer is not constant, and the pain experienced arises from the irritation produced by external agents, there is reason to believe that the irritability of the sore depends upon the exposure of the nerves; and this condition is usually relieved at once by the application of nitrate of silver; while, on the contrary, when the pain is constant, calomel and opium are indicated, and such constitutional remedies as relieve irritability generally.

Care must be taken that ptyalism is not produced by the calomel and opium, as the nervous excitement will otherwise be increased instead of diminished.

Gentle tonics are generally beneficial after the irritability of the nervous system has been subdued. Sarsaparilla, bark, mineral acids, camphor, and similar remedies, are those which are usually employed.

For a topical application, after having made use of the nitrate of silver, I almost invariably order the following lotion:—

℞ Pulv. opii, gr. iij.
Mucilag. g. acaciæ, ℥j.
Liq. calcis, ℥v. M.
Fiat lotio.

As soon as the irritability of the sore is diminished, the granulations rapidly assume a healthy aspect, and the character of the disease is at once changed.

Such a condition of ulcer not unfrequently attacks the rectum, under the form of a narrow elongated fissure running along one of the folds of the mucous membrane near to the orifice of the anus. The edges of the fissure are free from any callosity, and it bears a strong resemblance to the cracks which frequently affect the lips.

The most usual situation for the ulcer, as far as my experience goes, is at the posterior coccygeal aspect of the rectum in the mesial line, although I have sometimes found it on the side of the bowel. The ulcer may involve merely the edge or the verge of the anus, or extend a considerable way up the intestine, but may always be detected by passing the finger into the rectum, when the nature of the sore is readily appreciated by the extreme pain which the patient experiences directly the finger comes in contact with the fissure.

The symptoms of the disease are highly characteristic: a burning pain is experienced during the act of defæcation, which continues for a considerable time after each evacuation. During the intervals the patient enjoys comparative ease, but still occasionally suffers from heat and lancinating pain about the anus, but nothing to be compared to the agony produced by the passage of the fæces over the ulcerated surface and through the sphincter, which is commonly more or less in a state of spasmodic contraction.

The bowels are in these cases generally constipated; now this symptom involves the question as to whether this constipation is not produced rather by the intolerance of the patient to evacuate his bowels than from any derangement of function. The best, and, indeed, the only positive evidence of this disease, is the introduction of the finger into the rectum, which, on being withdrawn, will be marked with a streak of blood, and lead to the discovery of the size and position of the ulcer.

If the disease be allowed to remain for any considerable time, the patient's health becomes seriously affected by the constant suffering, and from the countenance one might suppose that the disease is of a malignant character. The digestive functions become deranged; the appetite fails; the slightest exertion, such as the act of coughing or blowing the nose, are sufficient to excite the pain; and any excess of diet is sure to aggravate all the symptoms.

Although this distressing affection will not yield to the remedies recommended for irritable ulcers in other parts of the body, its treatment is fortunately very simple. It consists in passing the fore-finger of the left hand up to the ulcer, and directing along it a straight probe-pointed bistoury, beyond the very extremity of the fissure; then, turning the cutting edge towards the sore, the ulcerated surface is to be divided, as well as the subjacent fibres of the sphincter muscle.

This procedure is usually sufficient, but if there be any reason to believe that suppuration has taken place in the cellular membrane beneath, the incision should be continued so as to divide the verge of the anus, and thus insure a free exit for the matter.

In the after-treatment I strongly recommend (when the patient has recovered from the effects of the operation) that he be directed to acquire the habit of evacuating the bowels at bed-time, instead of in the morning, so as to secure the six or eight hours' subsequent recumbent posture, and the certain receding of the rectum into the pelvis; a result which does not occur in a diseased state of this bowel if the patient follows his daily avocations immediately after the act of defæcation. This disease I have certainly found more frequent in females than in males, and to prevail rather in the higher than in the humbler classes of life.

It is to Mr. Copeland that I am indebted for a knowledge of this disease, as well as for the operation, which I believe I may describe as almost infallible as a means of cure.

Sinuous ulcer.—In some cases ulceration extends a considerable distance into the cellular membrane under the skin, forming what is called a sinuous ulcer, which is often very difficult to cure. Such a sore is likely, therefore, to be produced where the areolar tissue is most abundant: hence we find it very frequently seated by the side of the rectum, in the axilla, and in the inguinal regions.

These sinuous ulcers generally follow abscesses, in which the pyogenic membrane becomes converted into a kind of mucous membrane. For their cure they require to be laid open along the whole length of the sinus before they can be made to granulate; and generally the fibres of some muscles which influence the sore require to be divided before it can be induced to heal. This fact, indeed, constitutes the pathology of the cure of fistula in ano, which is nothing more than one of these sinuses prevented from healing owing to the action of the sphincter ani.

Many surgeons have recommended stimulating injections for the cure of these sinuses, but I have never known any benefit derived from their use, and should, *à priori,* expect no good to result from them, unless the ingredient injected possessed an escharotic power sufficient to destroy the tissues with which it came in contact, and even then they would be less certain in their operation than the knife, and assuredly much more painful.

Setons are sometimes employed in these cases, and if used as a ligature, that is, tied with sufficient firmness to lead to the ulceration of the part included, they produce a cure much in the same way as the knife, and in cases where there has been reason to fear hæmorrhage, I have employed setons for the division of fistulæ with complete success.

After a sinus has been divided, the wound should be filled with lint, to secure the formation of granulations along its whole length.

In the groin I have sometimes found it extremely difficult to get the sinuses healed after they have been laid open, and the difficulty has appeared to arise from the motion of the hip-joint tearing the granulations asunder as quickly as they formed. This result may be obviated by putting the limb up in a straight splint, (Dessault's,) which completely prevents motion, and the wound rapidly heals. I have lately had several cases, both in public and private practice, fully corroborative of the utility of this method. One case, in particular, I attended with Dr. Gardner of Orme-square, Notting Hill, in which we cured, in a month, a sinus that had remained unhealed for several months before this plan was adopted. Tonic medicines, generous diet, and slight stimulus, will usually expedite the cure of such sores.

Varicose ulcers.—Some sores have acquired this name from being found concomitant with a varicose condition of the limb upon which the ulcer is placed, and from its being supposed to depend upon the altered and diminished nutrition of the tissues, in consequence of the disease of the veins; most obstinate ulcers are certainly often found on the lower extremities, caused by varicose veins.

The state of the veins which leads to ulceration, is produced by over-distention with blood, preventing the adaptation of their valves; so that the vessel has to support an undivided column of fluid, instead of one, the continuity of which is interrupted every two or three inches by the interposition of a pair of valves. This condition may, moreover, be induced in any part of the body by a cause which, producing pressure in the course of a large vein, interferes with the venous circulation.

Nature in some measure compensates for this functional disturbance by giving to these diseased veins a tortuous course, so as to bring the parietes of a portion of the vessel at right angles to the perpendicular column of the blood, and thus making it perform, in part, the office of a valve. Such a condition must necessarily alter the nutrition of the limb, the evidence of which is generally rendered first apparent by a tendency to desquamation of the cuticle, and inflammation of the true skin, which frequently inflames and ulcerates. The ulcer thus produced is usually of an elliptical form, extending in the course of the vein, and its granulations rarely rising above the level of the skin. If the patient has been in his usual avocations, the granulations are generally of a dark colour, as if congested with blood; and the advantages of rest, and the recumbent posture, are made evident by the granulations assuming that florid red colour which they present when formed in a healthy wound.

The most ordinary cause of varicose veins is constipation of the bowels, which becoming loaded, press upon the iliac veins, retard the ready return of the blood from the lower extremities, and produce the venous congestion. The disease more frequently occurs, therefore, in the left extremity, in consequence of the accumulation of the fæces in the sigmoid flexure of the colon, and the close proximity of this intestine to the left iliac vein. Constitutional treatment in these cases is principally to be relied on, and active purging most indispensably indicated: at the same time, the recumbent posture must be strictly enjoined. The diseased limb should be supported by a well-applied bandage, so placed that the degree of pressure is perfectly equable over the whole surface of the limb. Should the veins not become relieved by this treatment, but remain distended, although at the same time quite free from pain, or any other sign of inflammation, blood should be extracted from them by opening them with a lancet, and it is surprising to find the quantity of blood which may in this way be abstracted without producing any constitutional disturbance: this appears to depend upon the fact that the blood in varicose veins is thrown out of the general circulating course, and remains comparatively stationary in the diseased vessels, and therefore not belonging to the systemic mass of blood.

Persons, have, however, been known to bleed to death from a varicose vein giving way under violent exertion. A case of this kind fell under my own observation. Captain P., while skating, suddenly observed that his track was marked on the ice by blood; he soon became faint, fell, and died before he could be carried home. Upon examination, it was found that the saphena vein, which was in a highly varicose state, had burst. After having opened a varicose vein with a lancet for the relief of an ulcer, as I have already recommended, should there be any difficulty in checking the flow of blood, it may generally be stopped by placing the patient in the recumbent posture, raising the limb, bandaging, and applying evaporating lotions. But with all these remedies, very great difficulty will often be found in healing a varicose ulcer, and applications to the sore itself are required, as well as constitutional alterative medicines.

Black-wash poultices should therefore be applied to the ulcer; Plummer's pill given every night; decoction of sarsaparilla, with very small doses of bichloride of mercury, prescribed; generous diet allowed, and rather an active state of the bowels constantly maintained.

The obliteration of a varicose vein leading from the ulcer has been and is very generally recommended as a mode of curing the sore; but we ought to hesitate before performing this operation; we have, no doubt, heard of successful cases, but such, much more freely gain publicity than those which prove fatal, and, as far as I have seen, the operation is futile, even if the patient survives; for as soon as the vessel is tied, other vessels become distended, and subject to the same varicose state.

James Grover, æt. 51, labourer, residing at Farnham, a married man with eight children. Healthy appearance, general health good, with the exception of occasional attacks of lumbago.

Admitted April 15, with a tumour on the inside of the right knee, about the size of a large walnut, very moveable in all directions, and quite smooth to the touch; when compressed, it gave the impression of a cyst containing a semi-fluid mass. He stated that about six years before, he first perceived a swelling in this situation, at that time as large as a small marble, and it continued gradually to increase to its present size, but he was enabled, for a long time, entirely to disperse it by pressure, (to use his own words, "as if it contained air,") returning, however, as soon as the pressure was removed. Three weeks since, it was opened by a surgeon in the country, and more than half a teacupful of dark-coloured matter resembling coagulated venous blood, was discharged. This was not all contained in the tumour, but continued to issue forth when pressure was made on the veins, which were in a varicose condition. Strapping was applied tightly over the incision, which healed in a few days, but the tumour soon reappeared, and on his admission it was as large as it had been previously to the operation.

The tumour presses upon the long saphenus nerve, throughout the whole course of which, below the knee, the patient feels severe pain.

The superficial veins of the thigh appeared in a normal condition. Ordered,—to keep the leg at rest,—

℞ Dec. sarsæ, ℥viij.
Liq. hydrarg. bichlorid. ℥j.
Capiat. cochl. larg. ij. ter die.

April 21.—An exploring needle was passed into the tumour to-day, and a small quantity of grumous blood escaped.

27th.—An incision was made this morning into the varix of about an inch in length, and about four drachms of coagulum were turned out. The coats of the vein were found very much thickened; the vein leading to it from below appeared to be obliterated, but that above was pervious.

The wound closed with strapping; splint placed behind the knee, and secured in its position by a bandage, extending from the toes to the middle of the thigh.

28th.—Wound healthy, but there is a considerable degree of irritative fever. Ordered poultice.

29th.—Pyrexia all gone. He now went on well till May 6th; the wound granulated, and suppurated freely, and he had no bad constitutional symptoms.

On the 1st of May he was ordered some porter.

6th.—Had no fresh symptoms till last night, when he was attacked with headache, and he complains this morning of great nausea. He has vomited twice a quantity of bilious matter; no rigors; tongue slightly furred; pulse quick; skin hot and moist. The wound is very healthy and free from pain, except on pressure being made on the internal saphena vein, about four inches below the opening: there is no abnormal appearance externally; joints are free from pain.

7th.—Appears very much depressed.

10, A.M.—He cannot articulate his words distinctly: tongue white and clammy; pulse 92, extremely small: nausea still continues, and he has once vomited some more bilious matter; bowels open; stools dark-coloured and loose; skin still hot, but his extremities are cold; still pain on pressure as low down as the inner malleolus; no rigors.

2, P.M.—Attacked suddenly with severe rigors, which lasted half an hour, preceded by a low delirium; respiration hurried, and countenance indicative of great distress. It was impossible to count his pulse during the attack, but at its termination it was fluttering and 132; the skin, which had been pungently hot and dry, became suffused with a profuse perspiration; when spoken to, he answers in a very incoherent manner.

On removing the bandage, the course of the saphena major vein, and some of its branches, could be distinctly traced on the surface by a number of red lines, and on the slightest touch he cries out with pain. Above the wound, the veins of the thigh are not at all affected, nor is there any pain or swelling about the inguinal glands. Ordered Opii, gr. ij. statim; brandy-and-water; hot water to the feet, and the whole limb to be enveloped in a linseed poultice.

℞ Liq. ammon. acet. ℥ss.
Liq. opii sedat. ♏v.
Mist. camph. ℥iss. M.
Ft. haustus 2dis horis sumendus.

5, P.M.—Surface of body still covered with a profuse sweat; appears unconscious of what is going on around, nor does he answer when spoken to.

From this time he gradually sank, till half-past 12 the same night, when he expired, having been for some hours comatose. An inspection was made sixty-five hours after death, when all the superficial veins were distinctly marked out through the skin by a deep purple colour. The coats of saphena major vein, both above and below the varix, were much thickened, but no pus was discovered in any vein or elsewhere; all the internal viscera were very much softened.

I believe I may say, therefore, that no means are known by which we can promise a cure, at least in bad cases of varicose veins and consequent ulcers; and although much relief may be given by judicious treatment, permanent cure can never be anticipated with much confidence. Pregnant women are especially liable to varicose veins, and the frequent recumbent posture, with the extremities well supported by bandaging, should be strongly urged during the period of uterine gestation.

Menstrual ulcer.—If females labouring under amenorrhœa happen to be the subjects of an ulcer from any cause, periodical discharges of blood not unfrequently take place from the surface. Distinct premonitory indications of bleeding from the wound show themselves by a change in the appearance of the granulations, which become turgid and highly congested before blood exudes; this condition arises from a disordered function of the uterus, and it is by constitutional remedies principally that we can hope to restore that organ to its natural and healthy state. By the administration of the following remedies, I have rarely found much difficulty in effecting the desired object:

℞ Pil. aloes c. myrrhâ, g. v.
Fiat pil. omni nocte sumenda.

℞ Misturæ ferri co. ℥i.
Decoct. aloes co. ʒiij. M.
Fiat haustus bis quotidie sumendus.

Warm baths two or three times a week usually expedite the cure; should the patient be of an irritable diathesis, opium may be advantageously combined with the other remedies.

I have done my best, in the preceding pages, to describe the treatment of the different kinds of ulcers, so as to show how, from the appearance of the granulations, it may be determined whether they depend upon constitutional or local deterioration; much more may be necessarily required than I have recommended, for it is impossible to lay down general rules for the treatment of every variety of sore, or even for the most simple kind, without leaving much for the exercise of the practitioner's own judgment in the choice of the appropriate remedies for the particular case before him.

Before attempting to prescribe, we should consider well all the circumstances and causes which have produced the lesion; we should ascertain whether or not any specific poison is keeping up the diseased action; in which case unless an antidote be administered to destroy its influence, the application of means to induce the healing of the wound can be but futile. Extraneous substances, such as exfoliating bone, foreign bodies introduced into tissues, as needles, &c., may keep up an ulcerative process, and no hope can be entertained of checking this ulceration until the exciting cause be removed. This being effected, the ulcer becomes healthy, unless the violence of action produced by the introduction of the foreign body has destroyed the vitality of the tissues, or the constitution has become affected, and the restorative action disturbed in consequence.

The growing in of the nail into the soft parts of the fingers or toes often excites a high degree of both local and constitutional irritation, and unless the cause be removed, all efforts either to cure the ulcer or improve the constitution must fail. The means employed to produce the desired effect may be either palliative or radical—the former in recent cases will sometimes succeed; it consists in scraping the nail until it is as thin as possible, and then, passing a probe under its inverted edge, it is to be turned up, and a piece of lint dipped in a solution of lunar caustic inserted under it. I have rarely found this treatment prove permanently successful, for as the nail grows it again presses into the fleshy parts as before. The only effectual means I know of is the complete dissection of the nail from the sensible papillæ—an operation which I confess requires considerable firmness, both on the part of the patient and surgeon. Those ulcerations which arise from specific actions, whether induced by malignant diatheses or peculiar animal poisons, will be described when treating of these particular diseases.

LECTURE XIII.

MORTIFICATION.

Generic term expressing the death of any part of the body—Premonitory phenomena—Gangrene—Sphacelus—Immediate cause of mortification—Remote causes, intense inflammation, debility, physical violence, or poisons—Some tissues more prone to gangrene than others—Case—Serous membranes — Rarely primarily affected—Condition of capillaries in gangrene—Limitation—Diffused gangrene—Liability to hæmorrhage—Liability to secondary ulceration—Line of demarcation—Progress of separation—Sawing off the dead bone—Gangrene from debility—Death of a part not always unfavourable—Sometimes induced by art—Gangrena senilis—Lesion of spinal marrow—Excess of heat—Cold—Poisons—Hospital gangrene—Treatment of gangrene — Furunculi — Situation — Treatment—Carbuncle—Distinction between it and furunculus—Situation—Treatment.

Mortification may be employed as the generic term to express the death of any individual portion of the body; for every part of the human system which is organized, or which possesses vitality, is liable, if its nutrition be destroyed, to pass into a state of mortification—in other words, to die.

The stage immediately preceding death is technically termed *gangrene;* while the actual death of the affected part is generally designated *sphacelus.* The term *slough,* again, is applied to a circumscribed portion of dead tissue.

If mortification attacks any part of the body essential to the life of an animal—any vital organ, the dissolution of the animal itself will very quickly follow; and even if the mortified part be not positively necessary to life, if the disease has much extended itself, the effect produced upon the constitution may be such as ultimately to produce death.

The immediate cause of mortification is impeded circulation, whether the remote cause be inflammation or debility, or the effect of physical agents, or poisons.

Intense inflammation.—Intensity of inflammation in itself rarely leads to sphacelus, unless there be concomitant constitutional or local debility, or some mechanical cause of pressure be in operation.

When violent inflammation is the cause of the death of a part, it is indicated by intense pain, diffused redness, great swelling, increase of heat, and, indeed, by all the usual signs of inflammation, which urgently point out the necessity of immediate local depletion, and, when circumstances will admit, the removal without delay of the cause of the excitement, in order that the action of the parts may be diminished before we employ remedies to increase their power and restore their healthy condition.

If the inflammation continues, obstinately defeating all the attempts made to subdue it, vesicles will make their appearance on the limb, frequently at a considerable distance from the inflamed part. These indicate sloughing of the cellular membrane beneath the skin: the destruction of the former tissue deprives the cutis of nutrition, and produces the effusion of the serum and red particles of the blood which constitute the vesicle.

At this stage of the local disease the constitution becomes affected: the pulse is quick, small, thready, irregular, and sometimes intermitting; the tongue frequently brown and dry; the bowels have a tendency to become costive; hiccough, with muttering delirium, supervene; and low or typhoid fever forms the sequel of that which commenced with a high degree of irritative fever.

But it is not always a constitutional tendency to gangrene which leads to the death of the part inflamed, for the nature and severity both of the constitutional and local symptoms vary according to the character of the different tissues subject to the disease. Those, for instance, which possess but a low degree of vitality, have a tendency to slough under less violent inflammation than the more highly organized parts, and a greater amount of constitutional irritation is consequently produced. The cellular membrane more readily than any other structure goes into a gangrenous state from inflammation, which extends with greater rapidity, but produces, perhaps, the least constitutional derangement, especially if early provision be made for the removal of the slough as soon as the vitality of the part has been destroyed. By this means the protracted injurious influence arising from the presence of an extraneous body, will be prevented.

The skin frequently mortifies, particularly after erysipelas and carbuncle, and this occurrence is denoted by its change of colour, temperature, loss of sensibility, and by the formation of vesicles. As soon as these signs present themselves, it should be ascertained whether this condition result from the sloughing of the cellular membrane beneath, and if that prove to be the case, openings should be immediately made for the removal of the subcutaneous dead structure. This is the mode of treatment invariably adopted for the cure of carbuncle, and it saves the skin from that extensive gangrene which would otherwise arise from the dead cellular membrane being allowed to remain in its original situation.

The mucous membranes rarely mortify. Sloughing does, however, sometimes occur in cases of chronic dysentery, or protracted inflammation of an intestine from any physical cause, as in strangulated hernia, &c. In April, 1839, a patient of Dr. Addison, who was labouring under a chronic disease of the bowels, attended with occasional purging, passed a perfectly cylindrical portion of membrane, rather more than three inches in length. The interior of the cylinder was studded with small dark spots, as if innumerable grains of coarse gunpowder had been strewed upon, and become adherent to, its inner surface. These spots were at first thought to be small depositions of blood and fibrinous matter; but afterwards, upon closer examination, in consequence of their grittiness, and as the person had been taking chalk mixture for some time, it was considered probable that they were composed of particles of chalk mixed with blood. The patient was much relieved by the evacuation of the slough, and ultimately recovered.

The mucous membrane of the bladder sometimes sloughs in consequence of over-distention, resulting from dysuria. I have also known sloughing of the urethra from the injudicious employment of too strong injections in gonorrhœa.

The serous membranes are still less frequently destroyed by gangrene than the mucous, but the peritoneum oftener than the pleuræ: when, however, they are thus attacked, the disease generally occurs primarily in the organ which the affected part of the serous membrane covers.

In gangrene, transudation of serum and extravasation of blood take place: hence the dark colour of the part which so generally presents itself.

The sensibility of the tissue thus affected is entirely destroyed, as well as its natural temperature, and sphacelus is now complete: the tissue of the affected part is dead; the blood in its vessels coagulated; and the matter which may have been exuded, disorganized.

The most favourable termination to sphacelus is that which is designated by surgeons *limitation,* which implies that the living parts have thrown out a quantity of plastic organizable fibrine, which performs the important office of circumscribing the dead tissue, in the same manner as adhesive matter constitutes a barrier to the diffusion of pus in abscess.

When, however, the effused matter is not composed of coagulable lymph, and therefore not capable of becoming organized, the sphacelus continues: or, in other words, no line of demarcation is formed between the dead and living parts.

This condition may depend upon want of power in the constitution, or in the tissue itself; either of which circumstances will prevent the effusion of plastic matter.

Under these circumstances, more especially in the case of constitutional debility, hæmorrhage frequently occurs; for, although the blood may have coagulated in the gangrenous part itself, so as to check the bleeding for a time, still, when the process of separation commences, the artery above the line of demarcation may not have become obliterated by adhesion, from the want of the plasma, and a discharge of blood will necessarily result on its division.

Another unfavourable event may take place during the progress of gangrene, or even sometimes after the separation of the dead from the living parts has been completed, namely, the ulceration of the granulations. This may occur from some secondary constitutional derangement, suddenly affecting their integrity and healthy nutrition; hence the necessity for carefully watching the general health, for paying great attention to every constitutional symptom, supporting as effectually as possible the powers of the patient, and, above all, for maintaining the healthy secretions.

When a case terminates favourably, and the line of demarcation is properly formed, separation takes place in the following manner:—

A white line denotes the point of separation between the living and dead structures, and usually indicates the cessation of gangrene.

The cuticle around this line desquamates from the true skin, which soon undergoes a process of disintegration, and becomes absorbed, although not a molecule of the sphacelated part itself is carried off by the absorbent vessels.

The cellular membrane is next removed, but the line of separation takes place at some distance from that point at which the skin disintegrates: indeed, the low vitality of the cellular tissue sometimes leads to deep and extensive sloughing sores, which conceal at times the true nature of the original disease, more particularly after erysipelas and syphilitic ulcers.

All the tissues ulcerate within the limits of the line of demarcation, with the exception of the bones and bloodvessels; the latter become filled with coagulated blood usually as high up as the first branch given off, and there is set up in the vessel an inflammatory action: this leads to the deposition of lymph, by which it is closed, and hæmorrhage prevented upon the separation of the trunk from which the branch was given off. The spontaneous removal of the dead bone is very slow, and it is but rarely left entirely to nature to perform the task, as its removal with the saw may easily and safely be effected if the period for the operation be happily chosen. It should not be attempted until the granulations secrete healthy pus; and in sawing the bones through, the greatest care should be taken that no injury whatever be done to the granulations: for if they be made to bleed, a tendency to slough may follow, and further gangrene be induced. The great benefit derived from sawing off the bone as soon as all the soft parts at the line of demarcation have been absorbed, is the removal of the deteriorating influence of the decomposing mass of dead matter. The decomposing matter confined in a slough produces a highly poisonous effect upon the system. The sulphuretted hydrogen seems to be absorbed and to enter into the circulation, giving rise to very dangerous symptoms, and often, indeed, appearing in itself to produce gangrene.

It should be observed that the structures occupying the space between the living and dead parts,—constituting, in fact, what is technically termed the line of demarcation,—are in a very different condition to the structures either above or below them. They have neither the high degree of vitality of the granulating surface above, nor are they dead like the parts below, but they are in an intermediate state.

When a portion of the body in immediate proximity to a joint is in a state of sphacelus, and the line of demarcation is situated at an articulation, although the dead bone may be perfectly exposed, it is, in my opinion, better to let nature separate it from the living structure, than to interfere with the process, as there is no bone implicated in the ulceration, and nothing but the ligaments to be disintegrated in order to effect the ready separation of the mortified parts. The appearance of the granulations above the line of demarcation forms the best indication of the kind of constitutional and topical treatment which ought to be employed, and those signs must ever regulate our practice rather than the adoption of any general mode of treatment, or series of favourite remedies, however high may be the authority for such a plan of procedure. Let it, however, be borne in mind, that whatever stimulates either the constitution or the part affected, without increasing the vital power, should be avoided: hence the necessity for administering bark, opium, porter, and remedies of a similar character.

Constitutional Debility.—That gangrene and sphacelus result frequently from constitutional debility, every day's experience tends to prove. It frequently occurs, for example, after typhus fever, and other adynamic influences: but still, even from this cause, death of a part is not always to be considered as an unfavourable symptom: nature occasionally adopts it for the general or partial relief of the patient; sometimes for the purpose of throwing off diseased structures, and sometimes to give exit to dead or foreign matter, as portions of dead bone, pus, or intruded substances.

We often imitate nature in this respect, by applying caustic alkalies, acids, chloride of zinc, &c., to hasten the separation of the parts, which cannot be thrown off until their vitality has ceased. These applications expedite their separation, not only by destroying the diseased tissues, but also by stimulating the surrounding healthy structures.

Still, however, the judgment must be exercised as to the proper choice of period for the application of these escharotics; for if, from constitutional or local debility, the living parts are incapable of supporting the stimulus they produce, an extension of gangrene may be induced, and infinite mischief be the result. Even leeches, blisters, or any counter-irritant which may perchance be coincidently indicated, must be had recourse to with the utmost caution. Almost every practitioner must have learnt from his own experience the danger of applying blisters or leeches after children have suffered from a severe attack of scarlet fever.

In hydrothorax and disease of the heart there is a great tendency to gangrene from any slight local excitement, especially in a part distant from the central organs of circulation, possessing in itself a low degree of vitality. Gangrena senilis frequently occurs from obstruction to the circulation, in consequence of an abnormal deposition of phosphate of lime in the coats of the larger arteries, from which they lose their tonicity and elasticity, and are consequently unable to supply the distant parts with blood.

It is on this account that old people frequently lose their lives merely from cutting a corn, or even from too closely cutting the toe-nails, so as to produce a wound, whence an inflammation is set up beyond that which the weakened parts are capable of sustaining, and gangrene follows.

Obstruction of the veins, from any morbid or mechanical cause, may also lead to gangrene.

The tendency to sloughing from lesion of the spinal marrow is very remarkable, although it occurs with such frequency. In this case the nates often become gangrenous, and this so rapidly, as to be scarcely attributable to mere pressure from the recumbent posture: it probably depends upon the influence induced in the ganglionic system, with which all the spinal nerves are more or less connected, and an interruption to the vital integrity of the arteries may result, and thus the effects be produced.

Physical causes of gangrene.—Severe contusions, gun-shot wounds, and other powerful local stimulants, such as various chemical agents, will at once destroy the vitality of the tissues brought under their influence, and the same processes will necessarily be required for their separation as when their death occurs from the diseased actions already alluded to. The tearing through of the principal artery of a limb may lead to gangrene; or a tumour, as an exostosis, may, by its pressure on an artery, cut off the supply of nutriment to the parts below so completely as to lead to their death.

The effects of ligature may be looked upon as another of the physical causes of gangrene. A ligature acts in two ways: it cuts off the supply of nutrient blood from the heart, and it confines within the vessels of the part which it includes all the venous blood which they originally contained. A part in such a condition must necessarily die from want of nourishment, and this effect is hastened by the venous congestion and tension of its tissues.

Ligature is frequently used in this manner in surgical operations for the removal of growths, when the knife cannot be safely resorted to. In applying a ligature it should be drawn as tightly as possible, in order that its effect upon the part may be certain: the pain to the patient is likewise less.

Excess of heat and cold will also produce the death of organized matter exposed to these agents. A temperature approaching to 160° produces vesication of the skin, but does not lead in healthy constitutions to the death of the parts, unless improper remedies are employed to produce reaction. For instance, if cold lotions, or ice, which have sometimes been recommended, be used, deep sloughs will follow; whereas, if tepid applications had been resorted to, the inflammation caused by the burn might have terminated in resolution.

Exposure to extreme cold rarely produces death of the part in this climate; but in Canada I have frequently known it to do so. I believe that the abstraction of the heat must be sufficient to produce coagulation of the blood before it can cause the actual death of the part; and when the degree of cold is not sufficient to produce coagulation of the fluids, sloughing does not usually follow.

If (as in the case of a burn) reaction be too suddenly induced, the subsequent inflammation may destroy the tissues which had already been weakened by the debilitating effect of the cold. The proper treatment, therefore, of a frost-bitten part, is to rub it well with snow, or place it in cold water, so that the return of its natural temperature may be exceedingly gradual.

Poisons.—Decomposing animal and vegetable matter, malaria, and foul air, from any cause, have a tendency to produce gangrene: this we frequently experience in crowded hospitals, where they produce what has been termed "hospital gangrene:" under this influence all the ulcers in a ward may simultaneously assume a gangrenous disposition.

This has been attributed to contagion, and generally to the careless use of dirty sponges, and similar causes, but, in fact, it results from the influence of contaminated air, and therefore must be regarded as purely endemic. This may be considered as pretty well proved, by the fact of the beneficial effects immediately derived from free ventilation of the building, or the removal of the patients to some other locality.

A surgeon would never think of performing any operation upon a patient under the above circumstances, without first doing everything in his power to obviate the tendencies arising from the local causes described. In December, 1848, hospital gangrene broke out at Guy's Hospital after continued rain and warm weather. Stumps after amputation, compound fractures, contused wounds, and leech-bites, all became gangrenous, attended with phagedænic ulceration of the skin. I applied nitric acid in all these cases, and did not lose a patient.

The bite of some species of serpents seems to produce an immediate tendency to gangrene of the part, as if some new constituent were introduced into the blood, which rendered it suddenly incompetent to afford nutrition to the surrounding tissues, owing perhaps to decomposition; or possibly by the actual destruction of the vitality of that fluid. Sometimes, however, without any apparent cause a spontaneous or idiopathic gangrene will arise, of which the following cases are examples.

A gentleman, Mr. S., æt. 45, (of Windsor,) was attacked in the summer of 1843 with a dry, burning sensation in the bottoms of the feet. It occurred sometimes in walking, but often when perfectly quiet, continuing for ten or fifteen minutes, and then passing away gradually. It sometimes came on in bed; the patient was then in the habit of rising and bathing the part with cold water. This seems, however, to have afforded but slight temporary relief, and most advantage was experienced at the time by a very low system of diet. In the autumn of 1845 a slight pain was first felt in the little toe of the left foot; the pain was accompanied by redness and tenderness to the touch, and the part afterwards became purple and black. These appearances spread to the next toe, and there were so much pain and weight when the foot was put to the ground, that the patient was quite prevented from walking. It was treated with hot and cold fomentations of henbane, and afterwards with poultices containing henbane and laudanum, and in the course of some time the flesh at the end of the toe, with the nail, sloughed off: ultimately, however, the part healed, and the nail grew again. In October, 1848, he was again attacked with a tenderness in the thick part of the right great toe, and round the nail of the next toe. The gangrene was at the time, however, confined to the great toe, and a slough separated from the upper part over the joint; this soon healed up, but left the joint quite stiff. The second toe then began to slough, the whole of the toe coming away, and leaving the bone exposed. The bone itself eventually came away, but before this the fourth toe of the right side became affected. At this period he first came under my treatment, when he was suffering from a constant burning heat in the part, and a line of redness existed across the dorsal surface of the articulation of the toes with the surface of the metatarsal bones. The toes themselves seemed to be ecchymosed, being cold, free from any exudation, and having the appearance of dry gangrene. The pulse was quick and feeble, his appetite bad, and his nights sleepless. I ordered him bark, nitro-muriatic acid, and large doses of opium, carefully regulating at the same time the action of the bowels by aperient medicine. I gave him also generous diet, with porter, and kept him in the recumbent posture, with the foot constantly enveloped in carded wool. Under this treatment the part was rapidly restored to its natural appearance, his health very much improved, and in about three weeks he came to town to show me the happy result of the treatment; but in a month after he again applied to me, in consequence of the little toe of the opposite foot being attacked: the same treatment was adopted successfully. Since that period I have never seen or heard from my patient.

The Rev. Mr. B., æt. 50, a gentleman of sanguineous temperament and gouty diathesis, but of vigorous constitution, was seized, while in his usual state of health, with a violent pain on the outer side of the left foot. He at first supposed this to be a fit of gout, but at the same time remarked that the pain was quite of a different character to that which he had experienced in former attacks. At this time he consulted me; I found a patch of inflammation spread over the dorsal and plantar surface of the metatarsal bone of the little toe. The skin was red, but not tumefied, the cuticle desquamated, and the surface of the cutis drier than natural. His bowels were constipated, the pulse strong and full, and there were indications both of constitutional plethora and debility. I ordered him aperient medicines, strong enough to act freely upon his bowels, recommended him to keep in the recumbent posture, and the whole foot to be enveloped in carded wool. Two days after, the pain in the foot entirely ceased, the diffused redness had disappeared, and a separation of a slough, or rather a large eschar, took place. I ordered him tonic and aperient medicines, with generous diet and bottled porter, and although the slough was a long time separating, it left a perfectly healthy surface, and in about six weeks from his first attack he had quite recovered, and has never since had any return of the disease.

These two cases appear to me to correspond completely with the description of *chronic* or *dry gangrene ;* the latter term signifying the absence of that degree of effusion and general humidity which accompany mortification, resulting from a high degree of inflammatory action, which is almost invariably accompanied by a superabundance of fluid effusion. This idiopathic, or dry gangrene, generally makes its appearance either on the side of the foot, or between the toes, beginning with a small bluish spot, which gradually extends itself to the neighbouring parts, and to me the peculiarity of this disease seems to be the readiness with which the cuticle is separated, leading at once to the drying up of the cutis, which is so remarkably characteristic of it, and from whence it has derived its name. If a piece of skin, with the cuticle removed from it, be exposed but for a few hours to the influence of the sun's rays, it will rapidly become converted into a dry mass, having exactly the appearance of a spot of dry gangrene, while, on the contrary, if the cuticle be left upon the skin, it will retain its humidity for several days. Therefore, as I have before said, I am inclined to believe that the action induced by chronic idiopathic gangrene first leads to the separation of the cuticle, and this forms the grand distinction between it and common gangrene. The causes which lead to this affection are very obscure; and indeed, I may say, the disease itself is one but little understood. Any circumstance which interferes with the integrity of the circulation of the blood in the extremities, such as arteritis, pressure, local disease of bloodvessels, or alteration of the tissue of the affected part, may apparently lead, in certain peculiar states of the constitution, to chronic gangrene. It seems, however, that this state may also be induced as a consequence of that general deterioration of the blood which arises from the use of bad food, particularly in the case of certain kinds of diseased grain. Although gangrene produced by the use of diseased corn has not been seen much in England, in France it has sometimes assumed an epidemic form; and rye affected with the disease called ergot is said to be invariably capable of producing a gangrenous condition of the system, even in the lower animals, as well as in man.

Treatment.—From whatever cause sphacelus may have arisen, whether from the intensity of inflammation, constitutional debility, physical agency, or poisons, the first step is certainly to remove the exciting cause; and no benefit can be expected from the application of remedies to the affected part, unless means be employed to remove, if possible, or at any rate to mitigate, the abnormal influence exciting the diseased action.

Thus, in acute gangrene, the excited action will probably require local depletion for the purpose of relieving the congested vessels of the affected tissue: sometimes, indeed, the depletion should be general, although, almost at the same moment, it may be advisable to administer constitutional support, to aid the subsequent restorative processes.

In chronic cases no depletion is admissible beyond inducing a slight action on the bowels, which is generally required to prevent their becoming torpid,—a state almost to be considered as pathognomonic of the disease.

Generous and nutritious diet is generally indicated, but stimuli must frequently (especially in the country) be avoided until the line of demarcation is completely formed. The affected limb should be perfectly covered with "carded wool," for the purpose of maintaining a strictly equable temperature, prior to the limitation being established, and as soon as the demarcation is formed between the living and dead parts, stimulating poultices are generally required to assist in throwing off the sloughing portion: such as the following are generally employed;—port wine, stale beer-grounds poultices, nitric-acid lotions, and the epithema plumbi diacetatis. The latter application Sir Astley Cooper very frequently employed, and as I believe it is peculiar to Guy's Hospital, it may be useful to mention the ingredients of which it is composed—

℞ Confect. rosæ, ℥j.
Mellis, tinct. opii,
Liq. plumbi diacetatis, aa. ʒij. M.

As constitutional remedies, ammonia, bark, and opium, are generally administered, and frequently in the London hospitals wine or bottled porter. When gangrene occurs without any apparent local cause, and its origin can only be traced in the state of the constitution, the removal of the dead part by operation should never be attempted above the line of demarcation, as the stump would be extremely liable to become gangrenous. The bone may be sawn off as soon as a complete separation between the dead and living parts is established, and the granulations have secreted pus, but every precaution must be taken, as I have already mentioned, not to injure in any way the living structures.

Should much fœtor arise from the dead part, and its removal be not thought advisable, chloride of lime or zinc sprinkled over the bed and about the chamber, will be found extremely beneficial, as it decomposes the noxious gaseous matter emanating from the decaying animal substance, and destroys its baneful effects. But when gangrene follows severe accidents, and the death of the parts clearly depends upon the physical injury, unattended by any constitutional disturbance beyond that inseparable from the leison, amputation may be performed above the line of demarcation, as there is not the same reason to fear the incised surface assuming a gangrenous disposition: but even in this case the line of demarcation should be complete before the operation is performed.

Some surgeons have recommended amputation prior to the line of demarcation being formed, but I should doubt the propriety of such a step under any circumstances; as the delay in the limitation of the gangrene alone is sufficient indication of want of constitutional power, and consequent probability of the extension of sphacelus from the operation. In my opinion, a constitution which is incapable by its own powers of separating a dead portion from living structures, can ill support the additional irritation produced by a surgical operation, and in that case the attention of the surgeon should be wholly directed to the improvement of the general health of his patient.

An exception to the above practice may, however, be made, in a case in which the external injury is extremely severe, or some exciting cause of great constitutional irritation is present, and cannot be removed without amputation of the part. In such a case, amputation ought certainly to be performed, even although the sphacelus be still in progress; for there is no probability of the constitution overcoming or limiting the gangrenous tendency while the original cause of irritation remains still in operation. Some difficulty may arise in ascertaining whether the sloughing depends wholly upon the local cause, or whether it may not, in part, be the consequence of defective constitutional power. This is a point which nothing but experience will enable the surgeon to determine.

Furunculi, or boils.—It is almost unnecessary to speak of furunculi, or boils, separately from gangrene, as they, in fact, result from sloughing cellular membrane, and are therefore attended by very similar constitutional conditions to those that accompany gangrene generally.

Boils are scarcely ever caused by a local defect alone, but depend upon constitutional derangement; they arise most frequently from disturbance in the digestive organs, and show, in fact, a defect of the assimilative powers. They attack, indiscriminately, various parts of the body; but perhaps it may be said that they are most frequently formed on the posterior rather than on the anterior aspects. They present a conical form, with a hard firm base, and generally with a fluctuating apex; they are extremely painful to the touch, and rarely terminate by resolution. Their local treatment consists chiefly in freely laying them open to their base, so as to leave ample outlet for their sloughing cellular membrane, which is in fact the source of the irritation they produce. Black-wash poultices and fomentations also facilitate the separation of the dead cellular tissue from the living parts.

The constitutional means to be employed are indicated by the extent of the dyspeptic symptoms usually coincident; hence the necessity of gently opening the bowels, and afterwards administering bark and mineral acids. Patients the subjects of this disease appear to be very liable to its return, and usually require change of air to prevent relapse: sea-air seems to be particularly efficacious.

Anthrax, or carbuncle.—The anthrax, as well as the furunculus, is attended with sloughing of the subcutaneous cellular tissue, and I feel a difficulty in pointing out any distinction which can be drawn between the two; unless, indeed, it may be said, that the term anthrax is usually applied when there is but a single large instead of numerous small swellings occurring at the same time, and perhaps, also, when the disease attacks the old instead of the young. When carbuncle attacks old people, the diminished power of the constitution gives a peculiar character to the disease, which reacts more violently upon the patient's general health, and renders it a much more dangerous affection; not so much on account of the disease itself, as from the inability on the part of the constitution of the patient to promote and support the processes necessary to reparation. The late Dr. Prout pointed out a peculiar circumstance sometimes connected with carbuncle; he observed that it very frequently attacked persons who were the subjects of diabetes mellitus.

Carbuncle frequently attacks the cellular membrane at the back of the neck, forming a tumour of considerable size; the skin being of a deep reddish-brown colour, darker in the centre than at the circumference; the tumour feels very deeply-seated, and is surrounded by an extensive areola of highly inflamed skin. The suppurative process goes on very slowly, and the patient complains of burning pain, attended with considerable irritative fever, which soon puts on a typhoid character, unless judicious means be employed to remove the source of constitutional disturbance.

Early and free openings should therefore be made, to allow of the ready exit of the slough, and to relieve the extreme tension of the skin: this object is best effected by making a deep crucial incision to the very base of the tumour. Stimulating poultices should then be applied: the best is, in my opinion, a black-wash poultice, although stale beer-grounds are frequently employed in these cases. Should there be any difficulty in the natural separation of the slough from the living parts, it may be carefully removed by artificial means. It is sometimes recommended to employ caustic for this purpose, but, for my own part, I should fear that too intense an action might be induced upon the living parts to render its employment quite safe. The constitutional treatment is to be the same as in cases of more extensive slough, which have already been described in speaking of the treatment of mortification, namely, that first the soothing principle is to be adopted, at the same time the constitutional powers must be supported, and that subsequently stimuli are to be administered. The appearance of the granulations after the slough has separated will afford the best indication for the appropriate choice of remedies to secure convalescence.

LECTURE XIV.

ERYSIPELAS.

Erysipelas may be considered as belonging more to the province of the physician than to that of the surgeon—Character of the inflammation—Erythema—Local signs of erysipelas—Constitutional symptoms—Epidemic or endemic influence—Tendency to erysipelatous inflammation of head and face—Theory as to cause—Metastasis—Treatment—Inability to bear depletion—Punctures—Objection to long incisions—Employment of caustic and ointment to check extension of erysipelas—Rationale——Tonics—Support rather than stimulus—Often difficult to distinguish local inflammation of abscess from erysipelas—Liability to relapse—Necessity for attention to diathesis—Caution in performing operations where there is a tendency to erysipelas—Cases.

This subject may be considered as belonging rather to the province of the physician than to the surgeon; but erysipelas so frequently follows local injury, that unless a surgeon is acquainted with the phenomena, and the appropriate treatment of the disease, he would constantly be obliged to transfer the care of his patients to the hands of the physician. In fact, no better instance than erysipelas can be adduced to prove the necessity for a surgeon to render himself thoroughly acquainted with loco-constitutional disease.

Erysipelas is an inflammation of a very peculiar character, attacking the external surface of the body, and indicating all the usual signs of a morbidly increased action, attended with redness, heat, swelling, and pain, each of these offering characteristic marks. Sometimes it seems to attack the skin only, unattended with any concomitant constitutional disturbance; it is then termed erythema.

M. Blandin, of Paris, considers, however, that erysipelas invariably commences in the lymphatics of the cellular membrane, and that the inflammation of the skin is the consequence of its altered nutrition, produced by the attack. M. Velpeau, again, considers erysipelas to be an external phlebitis, and supposes the inflammation to be seated in the veins and not in the absorbents.

The redness of erysipelas is remarkable, on account of its sudden disappearance upon the slightest pressure, leaving a white spot; but the redness almost instantaneously returns upon the removal of the force. The intensity of the colour varies very much in different cases, and this variety depends more upon the constitution of the patient than upon the severity, or any peculiarity, in the disease itself.

The heat of the affected part is of a burning character, and is described by the patient as producing a dull pricking, or rather tingling, sensation. The degree of swelling depends upon the circumstance of the subcutaneous tissues being affected or otherwise; for when the skin alone is inflamed, there is little or no swelling or tension; and, in fact, the inflammation is at that period to be considered as merely erythematous; but, immediately upon the implication of the cellular membrane, swelling becomes a prominent feature of this disease.

The pain is seldom acute, but is said to resemble a tingling stiffness, and it produces invariably a restlessness which is highly characteristic of the disease. If pressure be applied to the inflamed part, the pain and uneasiness are very considerably increased. The local symptoms are generally preceded by considerable constitutional disturbance—such as pain in the head, full pulse, loss of appetite, rigors, followed by dejection, debility, sometimes vomiting, and early delirium, if the head be the seat of the disease. Although these symptoms likewise frequently attend common pyrexia, there is something so peculiar in their nature—so sudden in their development—that every experienced nurse in a hospital recognises them as premonitory signs of erysipelas.

Medical writers have distinguished erysipelas by the terms phlegmonous, bilious, and local or erythematous. Were I to enter into this detailed view of the disease, I admit that I should be rather encroaching upon the province of the physician. I shall therefore dwell especially on the disease resulting from local injury —"traumatic erysipelas."

The question naturally arises, whether injury to any tissue can in itself produce the specific action of erysipelas without accessory constitutional predisposition? I am myself inclined to reply in the negative: for I believe that this disease is the result of a constitutional derangement, arising chiefly either from epidemic or endemic causes; how frequently it is observed in hospitals, that, when one patient has become affected with erysipelas, others also become liable to its attacks from causes much too slight to be considered capable of producing such a result under ordinary circumstances. This is so well known, that every hospital surgeon postpones the performance of surgical operations, even after the patient has been prepared for the ordeal, if he is aware that erysipelas is present in the ward.

It is quite true that a healthy person would probably resist the infection; but, under the depressing influence inseparable from an operation, it would be incurring an unwarrantable risk, to expose a patient to the continued influence of such a poison, particularly if the case is one which will admit of delay. Under some circumstances erysipelas seems to assume a contagious character. The following case seems to corroborate this view, and also to give support to the supposition that erysipelas and phlebitis are very similar to if not identical with each other. Mr. Potter, the assistant of the late Mr. Liston, punctured his finger while dissecting; all the symptoms of phlebitis, or "internal erysipelas," followed, and he ultimately died of the attack; his mother and sister, who came up to attend him during his illness, were both seized with erysipelas in its common form, and were dangerously ill, but I believe recovered. The nurse was also seized with erysipelas, and died; the undertaker fell a victim to the same disease; and Mr. Liston himself, who saw him three or four times a day during his illness, was attacked by severe sore-throat and violent febrile excitement, from which he did not recover until he left London for some time.

There is certainly a peculiarity in traumatic erysipelas, with respect to its so frequently following wounds of the head and face; and I consider that this may depend upon the insertion of all the muscles of this region into the skin, a tissue early affected by this peculiar description of inflammation.

Hence, in the case of persons suffering from an attack of erysipelas in the face, the most complete state of quietude, and absence of all mental excitement, are desirable, as affording the only means of preserving these muscles in a perfect state of rest, as they are immediately put into motion by the operation of almost every external circumstance, or by the least mental disturbance.

Another peculiarity in erysipelas, not yet alluded to, is its erratic tendency, or what is technically termed "metastasis," which constitutes one of the most remarkable features of this complaint.

The consideration of this fact forms a very important point in regulating our practice, especially in erysipelas of the head; for, however proper it may be to attempt suddenly to subdue erysipelatous imflammation of the limbs or trunk, by the application of evaporating lotions, or any other means of abstracting the abnormal heat of the affected part, such treatment is quite inadmissible in erysipelas of the head or face, owing to the danger of producing metastasis to the membranes of the brain.

I have seen patients delirious a few hours after cold had been applied to an erysipelatous scalp, and restored as quickly to consciousness by the substitution of warm fomentations for the evaporating lotion. The rationale of this is sufficiently obvious: the action is due to the free anastomosis between the vessels of the pericranium and of the dura mater, through the substance of the bones of the skull; so that any cause which propels the blood from the pericranium must produce a proportionable influx into the vessels of the dura mater.

Patients attacked by erysipelas (more especially in this metropolis) bear depletion very badly, and there are but few cases in which general blood-letting can, in my opinion, be admissible.

In this country we have also a dread of the effects of applying leeches wherever there is a tendency to erysipelas,—believing that their bite alone is sufficient, under some circumstances, to induce an attack of the disease: this fear does not, however, seem to prevail in Paris, where the use of leeches in erysipelas is common. Blandin and Velpeau always apply them in the course of the absorbents between the inflamed part and the glands towards which the inflamed absorbents pass; and, according to them, this treatment is attended with great benefit.

The only antiphlogistic plan, therefore, left, is that of acting upon the secretions, which is readily done by employing the following remedies:—

℞ Hyd. chloridi, gr. iss.
Pulv. jacobi, veri, gr. iij.
Magnes. carbonat, gr. x. M. Ft. pilul.

℞ Sodæ sesquicarbonat. ℈j.
Vin. ipeca. ʒss.
Mist. camphoræ, ℥j. M. Ft. haustus, adde
Succi limonis recentis, ℥ss.
Et in statu effervescentiæ sumendus bis terve quotidie.

Should the patient manifest typhoid symptoms, ammonia should be substituted for the soda.

If there be much tension of the skin, attended with small vesicles without remission of febrile symptoms, it should be punctured in several places, to allow of transudation of the effused serum. This operation generally affords great relief. With respect to the long incisions recommended by some surgeons, I consider that practice to be worse than useless, unless there be extensive sloughing of the cellular membrane, which will very rarely occur if punctures be made as soon as the necessity for such relief is indicated by the tension of the skin: indeed, I have known fatal sloughing sores induced by the practice of incisions, and in more than one case, death to occur from the hæmorrhage immediately resulting from the operation.

When erysipelas becomes diffused, the vivid discoloration of the skin diminished, the tongue dry, and general signs of debility manifested, stimuli are required; but in common cases generous support is preferable to stimulus: I therefore usually prefer porter to wine or brandy, excepting under the circumstances above mentioned.

Where the inflammation of erysipelas has a great tendency to spread, it has been recommended to attempt to check its course by cauterizing with lunar caustic the skin above the inflammation. Some have recommended mercurial ointment to be employed with the same view; and indeed I have seen both of them produce beneficial results by circumscribing the extent of the inflammation. I presume that the lunar caustic and the mercurial ointment close the pores of the skin wherever it is applied, and preventing the natural cutaneous exhalations, set up a new action, and so tend to prevent the spreading of the erythematous inflammation; for, as far as I have observed, any other ointment will answer the purpose as well as the mercurial.

This fact would certainly lead one to the belief that erysipelas is, at any rate at its commencement, a cutaneous disease, and the extension to the subcutaneous tissues the result of a secondary action.

Vesicles generally form in those cases which do not terminate by resolution; hence erysipelas has been classed by Dr. Bateman under the order Bullæ.

In debilitated constitutions, diffused abscesses frequently follow erysipelatous attacks, sometimes even at a distance from the originally inflamed part. Indeed, I have occasionally seen abscesses follow wounds around which no erysipelatous inflammation had occurred, and yet, subsequently, diffused abscesses have formed in the cellular membrane in different parts of the body, attended with considerable local inflammation, but whether these could be regarded as erysipelatous affections I have had much difficulty in determining. What I mean to express is, that it is often very difficult to distinguish the inflammation leading to the formation of abscess in debilitated patients from phlegmonous erysipelas. In these cases, also, as in erysipelas, the abscesses are rarely limited by an adhesive boundary, but are diffused, indicating the extreme debility of the patient.

When abscesses result from erysipelas, they rarely extend beyond the subcutaneous cellular membrane, and do not appear to lead to absorbent inflammation, probably in consequence of the freedom with which the matter becomes diffused; while, on the contrary, when pus is formed in more deeply seated structures, as in subfascial and thæcal abscess, it is pent up by the inextensible tissues, and leads, therefore, to more urgent constitutional disturbance, and requires early evacuation.

Much care and attention are required after a patient may have apparently recovered from an attack of erysipelas, owing to the great tendency to relapse which generally exists in such cases; and it may, perhaps, be said—at least, so my experience leads me to believe—that a person once attacked by this disease is ever after liable to its return from any exciting cause of inflammation—a circumstance which would seem to prove that the disease depends more upon peculiarity of constitution than upon the nature of the accidental injury, or even, perhaps, than upon any epidemic influence.

I have said that it might be considered a deviation from my province, to speak of bilious erysipelas, and other particular constitutional derangements modifying this disease; still, it must not for one moment be imagined that I consider it unnecessary for the surgeon to study, and scrutinously too, the peculiarities, diathesis, and temperament of his patient: for it must be remembered, that the slightest local injury can never occur without the restorative process being influenced by the age, sex, habit, and constitution of the subject; and whoever fancies that, because he has made himself acquainted with the name of the disease, he can at once apply some well-known appropriate remedy, will never advance beyond empiricism, nor establish his title to be considered in the light of a scientific practitioner; and I would almost say that his practice would be dangerous in proportion to his rapid decision in the classification of disease, if that alone be his aim.

After what has been said, as to the tendency to erysipelas following wounds of the scalp, and skin of the face, let me urge the necessity of caution in undertaking even trivial operations, on these regions of the body, without first having duly prepared the patient for the effects they invariably produce in the system. In some cases, the surgeon may be requested to remove small encysted tumours from the scalp—an operation so trivial that it may be executed by a mere tyro in the profession; but even the most experienced and skilful surgeon may risk the life of a patient, and his own reputation, by want of a little precaution.

Never, I say, should such a task be undertaken without the actual state of the patient's health being first well ascertained, as to the absence of any organic disease, the condition of the bowels, state of the urine, and natural performance of the functions essential to a healthy state of the body.

Several years ago I removed an encysted tumour from the head of a patient. Upon making a mere incision through the skin, it immediately turned out, the operation not occupying more than a minute. On the third day I considered my patient convalescent; on the fourth I was suddenly sent for to see him, and found that a most startling change had taken place in his condition. I should not have recognised him; his head was swollen to twice its natural size; and his complaints were urged in muttering delirium. I immediately ordered him (as his bowels were costive) a large dose of calomel, fomented his head and face, punctured the scalp, and prescribed diaphoretic effervescing draughts. The day following he had but slightly improved, although his bowels had been freely opened; and I immediately proposed a consultation. The gentleman who met me recommended bleeding—a remedy to which he especially trusted in all cases of febrile action. But as the patient had a very dry tongue, attended with delirium, and was complaining of great thirst, muttering in almost inarticulate sounds his desire for porter, I proposed that we should try its effect: this was consented to, and I held a pint of porter to his lips; he drank it off at a draught—soon fell into a sound sleep; when he awoke he was perfectly free from delirium, and from that moment his recovery rapidly progressed. In relating this case, I do not mean to inculcate the propriety of the invariable use of stimulus, but I do believe that in most cases it will be found a safer remedy than bleeding, more particularly in London or any crowded city; nor have I formed this judgment from the solitary case just mentioned, but it is an opinion founded upon my own experience and the practice of my colleagues in Guy's Hospital, as well as in private.

A lady applied to an eminent surgeon, to ascertain from him whether a small encysted tumour could be removed with perfect safety from her head, to which he replied "certainly;" the operation was immediately performed, but seven days afterwards she was dead, from an attack of erysipelas. The next case, as the patient was not attacked by the usual form of erysipelas after the operation, may be considered out of place with regard to our present subject; I mention it, however, merely to exemplify the necessity of ascertaining the real constitutional condition before we venture to submit a patient to any mechanical lesion.

A short time ago, an individual came under my care with an external pile and a fissure in the mucous membrane of the rectum; he was considerably out of health, and attributed all his ailments to the sufferings he experienced in the passing of his motions, owing to the local disease; he urged me to relieve him by operation. I kept him, however, a week or ten days under my care before I operated, and, by soothing remedies, had somewhat improved his condition, when I removed the external pile, and drew the bistoury across the fissure, the whole time of the operation not exceeding half a minute. The patient felt immediate relief after the operation, he had little or no pain in passing his motions, but in the course of four or five days he was seized with symptoms of subacute peritonitis; calomel and opium, and leeches, were ordered, but four days afterwards he died.

Upon examination of the body, he was found to be the subject of granular kidnies, (the morbus Brightii,) which no doubt had caused his death.

It had been ascertained, during life, by my dresser, that his urine was albuminous; but I considered the severity of his suffering demanded the performance of this slight operation, although the sequel renders it a matter for consideration whether I was right, under these circumstances, in subjecting him to such a source of irritation.

Such cases as these show the necessity for doing everything which the science of surgery can command, to place our patient in the greatest state of security before we subject him to any surgical operation, and even then never to promise that any operation, however simple, will be perfectly free from danger; for, depend upon it, it is as unwise to treat slightingly the most trifling incisions of the skin, as it is dishonest to attach to an operation more importance than it justly deserves.

Some surgeons suppose that it is better to perform what are usually considered simple operations at the moment, than to allow the dread of anticipation to remain on the mind of the patient; and they act upon this opinion without any preliminary precaution. There are, however, I believe, but few patients who will not duly appreciate the cautious recommendation of a surgeon to submit to some little preparatory discipline, and he will gain much more confidence from the patient by this display of his judgment, than from the hasty recklessness which evinces boldness and self-reliance rather than judicious precaution.

LECTURE XV.

DISEASES OF BONE.

Physical properties of bone—Evidence of its vitality—Disease of bones modified by their earthy matter—their growth retarded by earthy matter—Diathesis may interfere in the formation of bone—Blood, capillaries, or tissue may fail—Scrofula—Necessity for constitutional remedies rather than mechanical—Chemical treatment—Hypertrophy—General—Partial—May or may not be disease—Exostosis—Diagnosis—Treatment—Operation; Sir Astley Cooper's operation—Cases—Exophthalmia—Hydrophthalmia—Diagnosis—Structure of exostosis—Hereditary tendency—Atrophy of bone—All bones not equally subject to atrophy—Atrophy of neck of thigh-bone—Rachitis, dependent on error in blood, capillaries, or tissue—Fragilitas ossium—Distortion of spine—Treatment.

I HAVE hitherto only occupied myself with the consideration of inflammation as a general principle; I must now speak of it in reference to its effects upon the various tissues of the body; and shall commence with a description of the changes which inflammation produces in bone.

Upon first taking a bone in your hands for examination, you may probably ask yourselves, if it be possible that such a solid mass (the characteristic hardness of which constitutes the peculiarity of the osseous system) can be subject to the same vital influences which attend the growth, reparation, and diseases of the softer and more delicate structures of the living body.

Such, however, is indeed the case: bone inflames, ulcerates, suppurates, and becomes gangrenous, like other tissues; like them, it is perfectly organized, and constitutes as completely a living part of the living organismus: and moreover, when broken, bone is capable of reparation from its own vital energy.

Bone falls into a state of disease more slowly than the soft parts of the body, and, having become diseased, is proportionably tardy in the natural process of restoration; this is probably owing to the quantity of earthy matter which enters into its composition, namely, the phosphate and carbonate of lime.

Bone consists, also, of organized animal matter, cartilage, and gelatine; and it is the admixture of the earthy with the animal substance which constitutes the great difference between bone and all the other structures of the body.

The natural growth and healthy changes in bone are much slower than in the other structures, and you may observe that the animal are much earlier formed than the earthy parts, for it is not until after the period of puberty that bones contain their due proportion of earthy matter; and this is the case also in their reparation after disease or accident.

In infancy, and even in early youth, the proportion of animal so far preponderates over the earthy matter, that the bones are comparatively soft and elastic, and they are also much more vascular than at a later period, and are consequently more liable to disease. Although, however, more subject to spontaneous disease, the bones in infancy are not often injured by mechanical agency, as from their elasticity they are capable of yielding to force, bending rather than breaking.

As all the bones do not possess the same proportion of earthy and animal matter, it is obvious that their periods of development cannot be simultaneous, and that some bones may run more rapidly into disease than others. Hence we find the round bones and the articular extremities of the long bones passing through all the phenomena of disease much more rapidly, and being developed earlier during the natural growth of the body, than the more compact parts of the osseous system.

The earthy matter of bones is generally described as inorganic, and so, chemically speaking, it must be considered; but its presence in the bones is essential to their healthy condition, and it contributes as much to their vitality as the animal parts, and is supplied in the same manner from the food taken up by the blood. The importance of bone must not be estimated from its physical properties, but from the office it performs, as constituting, in the animal economy, an organized system undergoing, like all other parts, constant change from the reciprocal action of the absorbents and capillaries.

I have already mentioned that the elimination of the earthy constituents of bone from the blood is a slow process, even in the most healthy condition of the body; we can therefore readily conceive that any deviation from health, or the operation of any deteriorating influence, will interfere with the due development of the osseous system.

Instances of such interruption to the development of bone are constantly brought before our notice in the numerous cases of scrofula which are admitted into this hospital, a large proportion of which are the subjects of diseased bone.

May we not learn from this how much depends upon dietetic observances in the treatment of diseased spine, rickets, and scrofulous joints? and how necessary is attention to those rules which are best adapted to restore nutrition by improving the general health of the patient, and by increasing the assimilative powers, instead of, as is too frequently the case, directing all our attention to mechanical means of supporting the weight of the body?

When the balance between the secretion and absorption of osseous matter is permanently disturbed, it may happen that the proportion of bone earth may become so deficient, that the bone, instead of assuming the hardness and solidity peculiar to it in its normal state, remains soft and flexible: this condition is known as "mollities ossium;" it no doubt often depends upon the want of power in the organs of assimilation to render the phosphate of lime contained in the food fitted to be taken up and conveyed to the blood by the absorbents. If such be the case, phosphate of lime cannot be eliminated from the blood by the capillaries of the osseous system, and the bones will consequently be deficient in earthy matter. This may, perhaps, also occur from a particular kind of food, not containing a sufficient quantity of phosphate of lime to furnish the supply required by the bones; hence they may remain soft and yielding, and unfitted for the purposes they are intended to fulfil in the animal economy.

This fact may be demonstrated by a very simple experiment: if you entirely deprive common fowls of lime, by keeping them confined in a locality where they have no opportunity of getting it, their eggs will be without shells, although, directly the calcareous constituent of egg-shell is restored to them, they re-acquire their natural earthy covering. A similar effect is probably produced in the human subject, with reference to the earthy matter of the bones: if the digestive organs be incapable of assimilating the phosphate of lime from the ingesta, the bones will become soft, from being deprived of their earthy constituent.

It is, however, probable that something more than mere disordered nutrition is the cause of this disease, and that it is concomitant with some peculiar constitutional taint, as it has hitherto proved uncontrollable by any mode of treatment, and frequently terminates fatally.

I have on two or three occasions certainly had reason to believe that great benefit was derived from giving bone powdered and mixed with bread, and at the same time draughts containing phosphoric acid, to convert the phosphate of lime into biphosphate, a more soluble salt than the phosphate, and probably more readily assimilated. The result of this treatment was certainly such as would warrant the expectation of facilitating the nutrition of bone. The disease is, however, too rare for much to be known respecting it, as sufficient opportunities of examination have not occurred for its character to have been closely studied.

Hypertrophy of bone is an enlarging, thickening, or increase of its bulk; and, regarding the subject in that light, it is not always to be considered as a diseased action.

If it were my task to prove to you, further than I have attempted to do already, that bones possess vitality, I should endeavour to do so by bringing forward the example of the enlargement of a bone from the excessive use of a limb. If, for instance, you examine the right arm of a man who is constantly employing it, and compare it with the left, you will often find it one-third larger, and marked much more strongly at the points of insertion of the muscles, indicating the proportional development of the muscular system.

There can be no doubt that this increase is dependent on muscular action, and therefore nature points out to us a most important fact, to be judiciously borne in mind in the treatment of fracture of bones,—which is, that a patient is not to be kept too long inactive; and although rest and the recumbent posture are most essential for a certain time, yet it will frequently be found that the employment of the muscles, and the effect of the weight being thrown upon the injured limb, is often the most ready and efficient mode of inducing ossific deposition. I have frequently seen the union of a fractured bone much retarded by too protracted a confinement to bed, and have hastened the reparation by desiring a patient to get up, and throw a portion of his weight upon the disabled limb. I need scarcely remind you, gentlemen, of the necessity to protect the broken bone at the same time by well-adjusted splints. This kind of hypertrophy, I say, therefore, is not to be considered as disease, but rather as a sign of health—a formative action. For you will not only find, after continued exertion, the bones increased in size, but the muscles and arteries also, and the whole apparatus for the nutrition of the limb in the highest state of perfection, to sustain the additional call made upon it in the performance of its duties. Indeed, it is a similar condition to that kind of inflammation which is sometimes spoken of under the term "formative inflammation," an example of which we find in the periodical increase of the vessels during the annual growth of the stag's horn, and of the spermatic arteries of those animals that have only certain seasons for the exercise of the procreative function.

This state of bloodvessels differs from inflammation (according to the common acceptation of the term), inasmuch as they still retain their tonicity, and are enabled to convey the additional quantity of blood, proportionable to the increased demand of the tissues for nutrition; so that the arteries, capillaries, and tissues, are all competent to the function they are by nature destined to perform: but when there is disease, true inflammation, the parts do not agree in their mutual conditions; there is a want of reciprocal action, and it is this which produces the morbid state. Therefore I do not speak of mere hypertrophy as disease, but only as an illustration and proof of the vitality of bone.

The disease termed *exostosis* may be considered as a partial hypertrophy of bone, but I will show you examples of the disease before I attempt to explain it to you. You will observe that the projections of bone in these specimens take place at the points of attachment of muscles, and are no doubt the result of their action, inducing a development of bone proportionable to the muscular power acting upon it. Examine the bones of the fœtus, of infancy, adolescence, of the adult, and of age, and you will find the strength of bone always corresponding to the development of the muscular system; so that if, from any circumstance, a particular muscle happens to be more than usually employed, there is probably a partial deposition of bone corresponding to the precise spot of the application of the inordinate action of the muscle: but even this partial hypertrophy can scarcely be regarded as disease, although I shall have to point out to you that it sometimes renders an operation necessary.

Such an enlargement may, however, interfere with the motion of a joint, and thus cause great lameness. Most of you must have heard of "the splint" in horses: this is partial hypertrophy of bone, and is of no importance if it does not interfere with the motions of the knee; when it does, it entirely destroys the value of the animal. The same interference may occur in the human subject, or the enlarged portion of the bone may press upon bloodvessels or nerves, and lead to important symptoms demanding surgical treatment.

The structure of exostosis differs in most cases from that of the bone from which it arises, and this change of structure seems to extend for some distance beneath and around the abnormal growth.

An exostosis may, accordingly, consist of cartilage, a kind of ligamentous material, more commonly of a peculiar bone containing cartilage, and sometimes of a very hard, compact structure, closely resembling ivory. The causes of exostosis, like those of some other diseases of the osseous system, are but ill understood. The disease certainly does not possess anything like a malignant character, and can only become dangerous, or even distressing, by the implication of some organ of importance.

Upon examination of the affected part, you will find a swelling, which you will readily discover to be an osseous formation, from the depth of its attachment, the hardness of its consistence, and its perfect immobility. If it does not interfere with the motions of a joint, nor press upon either a nerve or bloodvessel, so as to interrupt the natural functions of the part, the tumour should be leeched and blistered, which treatment will sometimes succeed in producing its absorption; but if, on the contrary, it does produce great inconvenience and hindrance to the natural uses of the limb, it must be removed by a surgical operation: this may be performed either by cutting down upon it, and sawing it off at its base, or by separating it by means of a pair of strong "bone-nippers" from the bone to which it is attached.

Sir Astley Cooper recommended what he considered a simpler, safer, and equally certain mode of procedure; but I think, as far as my experience has enabled me to judge, that his plan is more hazardous, and less certain to lead to the cure of the disease. He believed (as these true ossific exostoses derived their blood from the periosteum) that, if he stripped the membrane from the bony tumour, he should deprive it of its nourishment, and that it would be removed by absorption. This operation requires, however, extensive dissection and perfect exposure of the tumour, and renders it therefore more complicated at the time, and, consequently, more liable to produce subsequent constitutional disturbance. I prefer, therefore, the sawing or cutting off the bone at once. I have frequently performed the operation with perfect success, and have never known an instance of the return of the affection. The operation, however, of removing these tumours, either by saw or bone-nippers, requires some anatomical knowledge, and cannot be safely performed without strict attention to the possible implication of important bloodvessels and nerves.

Many years ago I remember seeing an exostosis removed by Mr. Levinge, who, although only a pupil at the time, displayed a degree of anatomical knowledge, and a ready application of it during the performance of the operation, which would have done credit even to a veteran in surgical practice. It is one thing, gentlemen, to know what should be done, but quite another to apply your knowledge at the instant the demand is made upon you to exercise it. To return, however, to the illustration. A gentleman consulted Mr. Levinge respecting a tumour, the size of a walnut, situated on the head of the left fibula, and which, during the motion of the knee-joint, struck against the external condyle of the femur, so as to interfere with walking. Mr. Levinge explained to him the nature of the swelling, and recommended its removal, which was readily consented to by the patient.

On exposing the tumour, Mr. Levinge, from his anatomical knowledge, was led to examine the relative positions of the fibula nerve and the exostosis, upon which he found that the anterior tibial branch of that nerve ran immediately through the substance of the adventitious bone. He immediately proceeded in his operation to remove a portion of the tumour with a small saw: in fact, he dissected out the nerve, and then sawed off the bony tumour. A careless or ignorant surgeon would have cut through the nerve, and probably permanently interfered with the motions of the toes and ankle-joint, or even produced great injury to the nervous system by the lesion of this branch.

On the 19th March, 1838, I saw my colleague, Mr. Key, remove an exostosis from the inner side of the left humerus, which was in such close contact with the brachial artery and ulnar nerve, that it required the nicest manipulation to remove it without injury to either of these important structures; but he most perfectly succeeded in avoiding both artery and nerve.

In 1842, I was consulted by Mr. P., of Cambridge, with an exostosis growing from the inner side of the femur, just at the point where the femoral artery passes through the large head of the triceps, and, indeed, the tumour in some degree pressed upon that vessel. On removing it, I had considerable difficulty in avoiding the artery, and, indeed, wounded a large branch which seemed to have nourished the exostosis, and which I secured with considerable trouble.

I have known persons admitted into the hospital with an affection supposed to be aneurism of the subclavian artery, but which, upon examination, proved to be an exostosis growing on the first rib, just at the insertion of the scalenus muscle. The circumstances in which these cases simulated aneurism, were pulsation in the tumour, swelling and loss of the power of motion in the arm, and a scarcely perceptible pulse at the wrist: but a just diagnosis was formed of these cases by producing pressure on the subclavian artery at the tracheal side of the tumour, and it was found that, although the pulsation had ceased, the tumour was in no degree diminished in size: moreover, when pressure was removed, the pulsation did not return throughout the whole surface of the swelling, but was confined to the course of the artery, extending only over a space corresponding to the size of the vessel.

One of these cases was admitted into Cornelius Ward, under the care of Mr. Key, and another under myself; neither of them were subjected to any surgical operation, but they left the hospital relieved by the rest to which they had been strictly enjoined. Exostoses sometimes grow from the bones of the orbit, producing what is termed *exophthalmia,* which disease may lead to the destruction of the visual organ: some tact is required to distinguish this condition from a protrusion of the eye produced by disease of the organ itself, termed *hydrophthalmia;* or even an enlargement of the lachrymal gland may so protrude the eye as to render the diagnosis difficult.

Dr. O'Beirne, of Dublin, has described what he considers to be a characteristic means of distinguishing between exophthalmia and hydrophthalmia, and as his published account of it has, I believe, never been contradicted, I consider myself justified in mentioning it to you. He states that, in hydrophthalmia, the eye is completely uncovered by the eyelids, while in exophthalmia it is more than usually covered, especially by the upper eyelid, which is generally more or less paralytic, its surface being of a dusky red colour, and traversed by enlarged veins.

It is not an uncommon circumstance to find persons possessing a constitutional tendency to the formation of exostoses, and I have seen some cases in which several partial growths of bone were present in the same individual.

I attended a child with Mr. Fred. Toulmin, of Hackney, whose face was dreadfully distorted by the growth of osseous tumours from the bones of the upper jaw, and I have, indeed, seen several children of the same family affected with similar osseous growths in different parts of the body, evincing a sort of hereditary tendency to the disease; for such cases can only be considered in that light, and therefore the peculiar diathesis seems to be the chief subject for the attention of the surgeon.

Atrophy of bone.—Atrophy of bone may result from disuse of bone, just as inordinate employment will tend to its increase; atrophy thus produced can scarcely be considered as disease, but seems rather to show that nature has a tendency to proportion the physical condition of every part to the strength required for the duty it is called upon to perform.

If you have the opportunity of examining the bones of a person who has died after a very protracted illness, you will find them much diminished in size; they correspond, in fact, to the atrophied condition of the muscular system.

But as hypertrophy may be a diseased action from an excess of bony matter and inordinate secretion, so may atrophy of the osseous system arise morbidly from the want of sufficient nourishment.

When amputation of a limb is required for the removal of a diseased joint which has been the cause of confining the patient to bed for a considerable length of time, the bone offers so little resistance to the saw that its atrophied condition is at once apparent; it seems, in fact, to have undergone a partial fatty degeneration. Infants are frequently born with imperfectly formed bones, particularly of the tarsus, which are only partly developed from some deficiency in nutrition, but they are almost invariably perfected as the child's strength increases. There is also an atrophy in the bones of old men; their compact structure becomes thinner, the cancellated structure softer, and they are rendered incompetent to fulfil their office, frequently breaking from the slightest force. You know, gentlemen, that in common language we speak of second infancy: this is not entirely a poetical expression; for in old age we do indeed sink into a kind of second infancy, not only mentally, but physically and physiologically. All the bones in old age are deficient in earthy matter, as might be expected, when we remember that their earthy constituents are the last parts formed in the development of the body, and, as one would naturally suppose would be, are the most difficult to replenish in old age; but all the bones are not equally liable to atrophy, nor is even every part of the same bone. The epiphyses of the long bones are peculiarly prone to this change; hence it is that the neck of the thigh bone in old people, more frequently than any other, yields to the weight of the body, not because this epiphysis is worse supplied with nutrition than any other, but because it is subjected to more physical force from the action of the muscles, and from the great weight it has to support under a mechanical disadvantage, owing to the unfavourable angle at which the force is applied. All the ephiphyses are subject to atrophy in consequence of their peculiar organization, being, in fact, extra-vascular, obtaining their nutriment in a manner quite different from that by which the rest of the osseous system is supplied; I shall, however, dwell more fully upon the circumstances connected with fracture of the neck of the thigh-bone when I am particularly considering that branch of the present subject.

Rachitis is a form of atrophy to which the bones of children are more particularly subject, and to which all the bones seem liable, but perhaps the round and mixed bones more especially; hence, the spine is so frequently affected in this manner. I believe that a distinction ought to be made between rickets and the condition I have described as mollities ossium: in the former disease, the imperfection of the bones seems to be only part of a generally deteriorated state of the nutritive functions; it generally shows itself before the age of puberty; it frequently leads to great deformity, from the bones being unable to support the superincumbent weight. In examining the peculiar characteristics of this disease, the question presents itself as to whether it is to be considered as arising from a general want of assimilative power—a deficiency of nutrition? or only from a defect in the elimination of the earthy matter from the blood; or whether the error may not sometimes arise from a local inability on the part of the tissue to receive its due constituents, while the blood and vessels which convey it are yet normal? It is generally attributed to defective elimination of the earthy matter from the blood, but it often, I feel convinced, results from inability in the digestive organs to convert the earthy matter contained in the food into that state in which it is fit to be carried into the blood; that it is not, in fact, properly dissolved, and is in consequence conveyed out of the system as excrementitious matter, thus indicating (under the peculiar circumstances) the employment of hydrochloric acid as a remedy.

In rickets, as in mollities ossium, there is a similar want of earthy matter in the bones; but it appears evident, not only that these diseases arise from different causes, but that they differ in some essential though unknown respect from each other. Rickets is a disease which in itself can seldom be looked upon as very dangerous to life, excepting through the deformity to which it may give rise, and generally the constitutional defect becomes corrected as the subject advances in years. Mollities ossium, on the other hand, is a disease, the progress of which is neither checked by medicine, nor the efforts of nature, but, so far as our knowledge of it extends, invariably goes on to a fatal termination.

Another singular abnormal condition of bone is that known under the name *Fragilitas ossium.* This is a disease in which the bones are so brittle that they break even from the mere action of the muscles which are attached to them; it is generally considered as being the result of the deposition of an undue proportion of earthy matter. I believe this ought not to be regarded as the cause but as the effect of a deficiency in the animal constituents: so that fragilitas, as well as mollities ossium, is a state of atrophy, probably arising from some radical defect in nutrition.

The tendency to this condition of bone seems to be hereditary, for I know at this moment a family in which three of the children are the subjects of the disease: their bones break from the slightest cause. One of the girls has broken both thigh bones three or four times: they unite very readily, but, as you may suppose, a considerable diminution in her height has been the result. Persons who have been long afflicted with malignant disease are prone to this brittle condition of the bones, which seems to prove that it is to be considered a state of atrophy, and not an inordinate deposition of earthy matter, as some suppose.

In the practice of your profession your attention will frequently be directed to the treatment of distortions of the spine resulting from the softening of the bones, and I feel, therefore, that I am bound to give you my opinion of the mode of treatment to be adopted. I repudiate the use of all apparatus and mechanical treatment of any kind for straightening a crooked spine, which confine the patient to the recumbent posture, and prevent by exclusion from air and gentle exercise the due performance of the natural functions, unless there be pain upon pressure in any particular point of the spine indicating inflammation and probably ulceration; under these circumstances the recumbent posture must be maintained so long as the above indications remain; but I believe blisters, moxas, setons, leeches, and other local means avail but little.

The disease is a constitutional defect in healthy nutrition, and can be remedied only by the improvement of the general health, although it is true, the application of simple mechanical means may aid this object so long as it does not interfere with the natural and vital functions of life. Use common sense, therefore, and bear in mind that however the preponderance of physical disturbance to the natural functions of the spine may attract your attention, this state is only a result of a general constitutional deterioration, and that without the improvement of health no good can be effected. The remedies must (to be useful) be directed to the removal of the cause of the disease, and not to the effects. You should do all you can to strengthen the assimilative powers; and as there is every reason to believe that the nutrition of bone is most at fault, means should be adopted, as far as diet and medicine can avail, to remedy the evil. Such diet, for instance, should be enjoined as contains most phosphate of lime: beef and mutton, and what is termed secondary bread, are therefore advisable: and phosphoric acid should at the same time be prescribed, for the purpose of its union with the lime, rendering it capable of being more easily absorbed. Bottled porter will also assist in improving the constitutional powers of the patient; and care should be taken that the bowels are not relaxed so as to carry off the lime too quickly, instead of leaving it to be taken up by the absorbents of the intestinal canal. The physical treatment indicated is to support the weight of the trunk by the most simple mechanical means competent to relieve the affected bones; and such muscles should be put into gentle action as have a tendency to counteract the unnatural direction the bones may have acquired from the influence of the existing abnormal causes, viz. the undue disposition of the weight and altered muscular action.

Patients labouring under this affection should be frequently in the open air, and should be permitted to take gentle exercise; but must avoid most cautiously the slightest fatigue either of body or mind: riding in an open carriage, or sailing on the sea, is the very best kind of recreation which can be adopted.

Tonics of different kinds,—iodine, and other alterative and sedative medicines,—may be indicated; but I cannot lay down a general rule to direct your choice of any particular remedies: your own judgment, and the experience derived from a knowledge of your patient's constitution should influence your selection.

This is all the advice I can give you as to the treatment of distorted spine; and although folios have been written on this subject, I can cull from them nothing beyond what I have just told you; unless, indeed, I entered into a detailed description of the various apparatus employed, the different gymnastic exercises recommended, the formulæ for the favourite medicines prescribed, and the recital of numerous cases illustrative of the too often imaginary efficacy of hypothetically infallible nostrums.

As the cases which are usually published are only the successful ones, they should be cautiously investigated before you are induced to follow the system recommended: be especially careful to ascertain that your patient is under precisely similar circumstances to those described as having been relieved by the particular remedy; for although a distortion of the spine, as you will readily suppose, must always be easily recognisable, still the causes which produce it are so various, that unless you form a just estimation of the true source of constitutional defect in each particular case, it is impossible for you to scientifically treat your patient, or avoid mere empiricism.

LECTURE XVI.

INFLAMMATION OF BONE.

Inflammation of bone—Distinguished from formative action—Effects of inflammation on bone the same as on the softer structures—Diagnostic marks between inflammation of bone and periosteum—Treatment—Anchylosis—Difference between the osseous deposit produced by inflammation and natural bone—Distinctions of syphilitic inflammation of bone and that produced by accident—Diagnosis—Treatment—Abscess in bone—Necessity for the evacuation of the pus—Treatment—Caries of bones identical with ulceration of soft parts—Treatment—Caries sometimes the result of the use of mercury—Disease of bone indicated by the presence of phosphate of lime in pus—Death of bone—Necrosis—Absorption of bone—Property of pus to dissolve bone—Removal of sequestrum by operation—Power of reparation in proportion to proximity to heart's action.

Ossific inflammation is the term employed to express an increased disposition to form bone, no matter whether such disposition be in the bone itself or the structures covering it. This action is actively going on during childhood, as the osseous system proceeds in development; it is purely a "formative" action, and cannot be considered to come within the usual acceptation of the term "*inflammation*," as there is not, under these circumstances, a greater quantity of blood sent to the bone, nor more of the ossific ingredients eliminated by the capillaries, than the tissues require. But when inflammation is produced and prolonged from the effect of external violence, pressure, or any other abnormal cause, the action between bloodvessels and tissues is no longer reciprocal, and medical treatment becomes necessary to subdue the excited circulation and restore the healthy equilibrium.

The effects of inflammation of bone are similar to those produced in the softer parts of the body—swelling, heat, and pain indicate its presence; but the termination varies in different bones, and in different parts of the same bone. The progress of inflammation in bone, compared with that in other tissues, is extremely slow; not so, however, in comparison with the other affections of the osseous system. It may exist in a latent form during a considerable period, and this circumstance ought to have its due weight with the surgeon in forming a prognosis after the infliction of severe blows on the head. The peculiar kind of pain perhaps constitutes the principal diagnostic mark of inflammation of bone; although it is frequently very difficult to distinguish the inflammation of the membranes from that of the bone itself, more especially as from extension of the inflammation from one tissue to the other, the former may become secondarily affected, although originally the diseased action was confined only to the latter. If a patient complains of a deep-seated, aching pain, which is much increased at night, attended with swelling, heat, and perhaps some redness of the skin covering the affected part,—and from the history of the case, you find that these symptoms have resulted from external violence, exposure to cold and damp, have followed the use of mercury, or any constitutional disturbance,—you may be certain that bone or periosteum is inflamed, or both. If the bone alone be affected, the progress of the disease is much slower than when the periosteum is the seat of the disease; so that your judgment as to the structure diseased may be formed from the acuteness of the symptoms, and the consideration of the structure of the bone affected.

Simple treatment is rarely effectual in inflammation of bone; its causes are generally of a kind which can only be subdued by constitutional treatment. Syphilis, scrofula, rheumatism, or gout, will often be found to be the origin of the disorder, and then it is seldom that local treatment will prove of much advantage, unless judiciously combined with a treatment directed more immediately to the constitutional defect of which the local lesion is a mere consequence.

In some cases, as, for instance, when the disease is supposed to originate in a syphilitic taint, the constitutional treatment must be carried on with caution, as a pertinacious adhesion to the use of mercury may not only prevent the beneficial operation of the local applications, but may itself produce caries of the bone. In the treatment of inflammation of bone it must always be remembered that organic changes in bone take place but slowly, and therefore the topical applications should be perseveringly continued for a considerable time.

Leeching, blistering, calomel, and opium, are the remedies to be generally employed, maintaining at the same time the recumbent posture. Under this treatment the inflammation generally terminates in *resolution*, unless the medullary membrane is inflamed, when death of bone usually results: fortunately, however, this is but of rare occurrence as the result of local injury, and I have only seen it follow amputations.

When the periosteum only is affected, the swelling and pain come on very rapidly, but the general symptoms are the same as in inflammation of the bone. The principal suffering results from the effusion between the periosteum and bone, and the consequent tension of the membrane: an incision should therefore be made down to the bone, which immediately affords great relief, by evacuating the effusion, and thus checking the inflammatory action.

It is not always that inflammation of bone can be brought to terminate by resolution, as it will sometimes resist all the means employed to produce this result, but, like inflammation in other tissues, it is liable to proceed either to adhesion, suppuration, ulceration, or mortification, passing through all the premonitory steps, although more slowly than in the softer structures. The tumefaction which occurs from inflammation of bone results from the deposition of osseous matter, just as the swelling in inflammation of the softer structures of the body is produced by the deposition of adhesive matter. And when this osseous growth extends from one bone to another, an anchylosis results, and the natural motion of the two bones is destroyed.

Before an anchylosis can occur, the structures entering into the composition of the articulation must have become absorbed; this frequently leads to so much constitutional disturbance as to render amputation necessary. If, however, perfect anchylosis is completed without considerable and permanent injury to the general health of the patient, the consolidation of the joint may be regarded as a happy termination to the disease, and it leaves the patient in a much better situation than if the limb had been removed.

Care should be taken, during the progress of anchylosis, to maintain the limb in such a position as will allow the patient after the consolidation is complete to perform the various necessary motions of the body with the least possible amount of inconvenience; if, for instance, the hip or knee-joint become anchylosed; allow the juxation of the limb to take place at such an angle that the patient may sit down without the necessity for the leg being thrust forward in an inconvenient manner; indeed, when it is slightly bent, the limb is better fitted to perform all its important offices, than if allowed to become anchylosed perfectly straight.

After fractures of the forearm or leg, it is not very uncommon for this ossific "adhesive deposition" to extend to the intermediate tissues, and to unite the two bones to each other.

The whole substance of a cylindrical bone may be implicated in the inflammatory action, although it is more frequently limited to one aspect of the affected bone, as we often see in cases of nodes, which may occur from local injury, pressure, diseased action as in syphilis, or from the irritation produced by the presence of a portion of dead bone.

The deposit of bony matter which results from inflammation differs very much in texture from the naturally secreted bone, and may be porous, compact, or intermediate; this depends in part upon the structure of the portion of bone affected, and in part upon the constitution of the patient, or upon the cause of the irritation which has induced the inflammation: in fact, inflammation of bone is regulated by precisely the same laws as inflammation of other tissues of the body.

When a bone becomes inflamed, we endeavour to subdue the inflammatory action by means very similar to those employed in overcoming inflammation of other structures, and if it goes on to the death of the affected part, we do all we can to assist nature in throwing off the dead portion by the process of exfoliation.

In practice we must take care that we do not too hastily attribute the partial inflammation of bone, and consequent enlargements resulting from an accidental cause, to syphilitic action; for nodes on the tibia frequently follow slight blows, or continued pressure: bricklayers, for instance, who, in carrying heavy weights up ladders, press their legs against the rounds to maintain their balance, are very liable to such enlargements, which are easily cured by rest and antiphlogistic means; whereas, the bone would probably exfoliate if mercury were administered in such cases: for, although it is the periosteum only which is first inflamed, it must be remembered that this membrane not only forms a covering to the bone, but that it passes into the intimate structure lining its cancelli; so that, by the extension of the inflammation, the whole substance of the bone may become ultimately affected.

It is from the history of the case, therefore, that the diagnosis must be formed, and, if there be no concomitant signs of syphilis, it is to be treated by simple antiphlogistic remedies—such as leeches, blisters, fomentations, calomel and opium at bed-time, and perfect rest; at the same time the affected limb should be kept raised, so as to allow of the ready reflux of the blood.

If inflammation in a bone continue for some time unchecked, that is, if it assume a chronic form, suppuration may take place just as it would do in other tissues of the body, and an abscess may be formed.

Abscess may result from inflammation in bone under precisely similar circumstances to those in which it occurs in other structures; it may form in any bone, or in any part of a bone, but it is much more commonly met with in the articular extremities of the cylindrical bones than in their shafts, and in the spongy than in the compact bones.

Suppuration in a bone may take place either on its surface or in its substance; when in the latter, the pus is confined, and causes considerable irritation until ulceration takes place and leads to its evacuation. Sometimes, when matter is formed on the surface of a bone, if it be slow in the progress of formation, new bone may so incase it as to confine it for a time—until, in fact, ulceration of the new shell of bone occurs, and sets it at liberty. The periosteum itself will often confine matter, and require an incision to permit of its exit.

Enlargement of the bone is almost invariably concomitant with the progress of suppuration, if deeply-seated, so that, while the abscess is increasing in the interior, new external depositions are going on ulmost indefinitely, and there is no limit to the increase in the size of the affected bone until the new substance ulcerates; hence the propriety of evacuating the matter as soon as its presence is ascertained.

The symptoms of abscess in bone are very similar to those of abscess in the other tissues of the body. The progress is, however, slower, the pain more severe, and the constitutional disturbance greater, owing to the continued irritation, from which no relief can be obtained while the matter is confined within the bone. At first a very dull, heavy pain is experienced, which is much increased at night, or upon the slightest pressure; rigors supervene, and, soon after, the pain is changed to a throbbing sensation. The skin next becomes discoloured over the seat of the abscess; and at the same time considerable swelling and hardness become evident between the skin and the bone, and, upon being cut into, it presents a scabrous appearance, owing to the effusion of earthy matter.

This condition alone in a great measure indicates the presence of an abscess; of itself, however, it could not perhaps be relied on; but when the symptoms I have just mentioned are present, suppuration may be pretty certainly diagnosed.

If the abscess does not open by ulceration of the skin at this period, the patient may be greatly relieved by the surgeon cutting down on the bone, and if, on dividing the periosteum, the bone should be found to be of a greyish colour, and of a worm-eaten appearance, and dry, a portion of it should be removed by a small trephine, and the pus evacuated.

When this is effected, the violent constitutional symptoms immediately disappear. In sawing through the bone, very little pain is experienced until you come down to the membrane which forms the sac of the abscess—the *pyogenic* membrane it may, perhaps, be termed; but directly this is touched by the trephine, the pain is excessive, and is described as being similar to the sensation caused by sudden pressure on the nerve of a hollow tooth.

The process by which the abscess is subsequently healed is exactly the same as in abscess of the soft parts; the pyogenic membrane, no longer entire, becomes incapable of secreting pus, and throws out a plastic lymph, which forms granulations, and these receive nutrition, when they arrive at the surface of the bone, from the capillaries of the periosteum; earthy matter is deposited, and new bone is now formed. The granulations continue to rise until they reach the level of the skin, restoring in progressive order all the deteriorated or removed tissues, and new skin being also formed, the cicatrization is complete, and the wound is healed.

This, however, is not invariably the termination to abscess in bone, for when the articular extremities are in a state of suppuration, the nutrition of the articular cartilages is interfered with, and their disintegration and absorption frequently follow; the exposed extremities of the bones which enter into the composition of the affected joint become inflamed in consequence of the removal of the cartilage; ossific adhesion and anchylosis naturally ensue. But even without this termination, abscess in bone is generally concomitant with a broken-down constitution, or a syphilitic taint.

Bone being more deeply seated than the other structures of the body, the diagnosis is more difficult than in disease of parts nearer to the surface, and it therefore requires a more careful investigation into the history of the case, and the temperament, constitution, and habits of the patient, before determining on the treatment to be adopted, as it may be found that, although external injury was the first exciting cause, constitutional derangement aggravates and keeps up the morbid action.

The treatment of abscess in bone is much the same as that in abscess of other parts; the first inflammatory symptoms require to be subdued by antiphlogistic means, and the matter to be evacuated as soon as its presence is ascertained, after which the granulating process must be assisted by such local and constitutional remedies as the peculiarities of the case may indicate.

Following as the consequence of a certain form of inflammation in bone, is the condition termed *caries;* this is identical with ulceration in soft parts, and both must be preceded by that kind of inflammation which has a tendency to soften down the inflamed structures—to lead, in fact, to their disintegration, to prepare them for their removal by the absorbents.

Caries is not confined to any particular class of bones; all are equally liable to be thus affected; indeed, cases are quoted in which the whole of the bones were more or less attacked in the same individual. External violence may sometimes be the cause of caries, but it is doubtful whether this can be the case unless there exists a constitutional tendency to the disease, or a certain pathological condition of the system, such as syphilis, scrofula, rheumatism, or gout, favourable to its development.

Syphilis is supposed to be a frequent cause of caries, but it is a matter of question whether the caries so often concomitant with syphilis, does not, in fact, result from the action of the mercury given to cure the specific disease.

There is often, however, some difficulty in discovering the syphilitic taint, for the appearance of the affected limb does not denote the venereal character; but when we find that the disease in the bone was preceded by sore throat, copper-coloured eruptions on the skin, nodes on the tibia, followed by rigors, and subsequent cutaneous ulceration, the nature of the case is rendered pretty obvious, and mercury is clearly indicated: the action of the remedy having reduced the disease to one of a simple character, it requires no further treatment than to support the constitutional powers.

When caries occurs in strumous constitutions, it is often difficult to distinguish it from that arising from syphilis, in consequence of the unhealthy aspect of the ulcerated soft parts, and their peculiar hard and everted edges. From the physical signs, a diagnosis can scarcely be formed, and we must seek for other indications to enable us to judge between the two. If there be no sore throat, no cutaneous eruptions, no cicatrix in the organs of generation, and the patient persists in declaring the impossibility of syphilitic contamination, while at the same time there are indications of a strumous diathesis, tonics, stimuli, iodide of potassium, and such remedies as tend to improve the general constitutional powers must be given, but mercury must be entirely avoided.

If symptoms of syphilis preceded the ulceration, mercury must be administered in the form of Plummer's pill, or bichloride of mercury, with sarsaparilla.

I have used the term "syphilitic taint" again and again, but

I am not sure that I have done so advisedly, for it is doubtful if this caries in bone does not result from the use of mercury, and not from syphilis. Who ever heard of a person having diseased bones in syphilis unless mercury had been given? Sailors have often been known to become infected immediately before embarkation, to have made a long voyage, and not to have taken any medicine. What is their condition? Extensive ulceration of soft parts, propagated, perhaps, by inoculation, on the thighs and scrotum, but no disease of the bones. Why, then, do we recommend mercury when caries has commenced? The answer is, I admit, difficult. I can only say that this is one of the few instances somewhat corroborative of the truth of the homœopathic hypothesis. Strumous ulceration, or caries, very often attacks the carpus, tarsus, jaw-bone, and spine—perhaps the latter more frequently than any other of the bones of the body. You must have observed the comparative frequency of lumbar and psoas abscesses; which are generally attended with a carious condition of the lumbar vertebræ. If the bones be not diseased, the prognosis is favourable. It is important, therefore, that this should be ascertained, and it may be readily effected by the chemical examination of the pus for phosphate of lime. If an appreciable quantity be obtained from an ounce of pus, disease of bone may be pronounced to be present, the extent to which it has proceeded being in some measure indicated by the quantity of phosphate of lime obtained. It is this strumous ulceration of the articular extremities of the bones which so frequently leads to the destruction of a joint, by cutting off the nutrition of the articular cartilages, producing disintegration and absorption of the cartilaginous matter, and ultimate anchylosis of the joint.

Bones are sometimes secondarily affected, and become carious from an ulceration destroying all the surrounding soft parts, and extending to the bone itself; this occurs frequently from lupus.

Lupus, however, is not, in my opinion, "a malignant" disease; for although it possesses a tendency continuously to extend, like a phagedænic ulceration, it is not propagated to distant parts through the medium of the absorbents, nor does it usually return if completely removed by escharotics. Still, if the disease be allowed to extend deeply enough to affect the bones, it generally terminates fatally—I should say by secondarily affecting the constitution, although it originally consisted in nothing more than a local deterioration of tissue: this circumstance constitutes a great and characteristic distinction between it and malignant disease. Caries may arise from simple inflammation, from syphilitic taint, from strumous diathesis, or from malignant disease. Caries, and other diseases of the bones, exercise a powerful influence on the constitution, as might readily be supposed from the constant and long-continued pain concomitant with them, and which may render necessary the amputation of the diseased limb, to relieve the constitution from an irritation beyond that which it is capable of supporting.

Inflammation of bone may terminate in its death. This is often termed necrosis, but I do not think rightly, for the term necrosis signifies that condition wherein a portion of bone has died, and in which the living parts of the bone and the periosteum, both above and below the dead portion, have thrown out new bone, so that the loss is eventually compensated for. A patient may, for instance, walk about with some inches of dead tibia supported by a shell of new bone formed around the dead portion, which is termed a *sequestrum.*

Such is the state of the parts in what is termed necrosis, but there is another form of death of bone called exfoliation, which must be considered as a partial death of bone, and, as in necrosis, which is a more complete death, there is a distinct transitive state analogous to that in gangrene of soft parts.

Necrosis and exfoliation both express, therefore, death of bone; the former may be described as internal, which leads to the deposition of new bone from the irritation which it induces on the living bone, and the latter external, from merely affecting the outer surface of the inflamed bone. Necrosis usually arises from inflammation of the medullary membrane; exfoliation from the inflammation of the periosteum. John Hunter has also described what he termed "mixed exfoliation," in which internal and external exfoliation were coexistent.

External exfoliation of bone may be produced by any cause which seriously impedes the nutrition of the bone—whether it be the effect of inflammation, debility, external injury, mercury, or malignant disease.

Exfoliation frequently results, therefore, from abrasion of the periosteum; the nutrition of the bone is then impaired, it is exposed, inflames, becomes scabrous, sloughs, and is thrown off as a thin lamina or leaf; hence the disorder is called exfoliation. The best treatment consists in assisting the process of separation, and expediting the ultimate healing of the wound; both of these indications are accomplished by the application of an acid, and phosphoric is far better than nitric acid, as it does not cause an equal degree of irritation and pain in the soft parts, and certainly promotes much more the separation of the dead from the living bone.

I have found so much advantage from this treatment that I cannot agree with those who consider local applications futile in such cases.

If exfoliation occurs in the flat bones, as in those of the skull, and through both tables, the reparation is very slow, requiring years to restore the lost portion.

Internal exfoliation, or necrosis, sometimes attacks bones idiopathically, but it is said to be seldom met with either in very early or in advanced periods of life, excepting when it attacks the lower jaw; from the age of ten to twenty-five seems to be the period at which the disorder is most frequent. The causes of necrosis resemble those which produce gangrene in soft parts;—excessive heat or cold, exposure to damp, interference with the circulation by which the bone is nourished, external violence, or any circumstance which can impede the process of nutrition, may be the cause of necrosis. A very slight contusion of bone, or even concussion, may be the exciting cause of this disorder; and it is said that necrosis of the bones of the leg has accrued after a simple fall on the feet. The death of the bone in necrosis is immediately followed by a reparative process, which may be divided into three distinct epochs, viz.:—*The separation of the sequestrum; the formation of provisional bone; and the conversion of provisional into permanent bone.*

Death in necrosis sometimes extends only to a limited portion of the bone, while, in other cases, the whole shaft may die: the same process is, however, resorted to for the separation of the dead from the living part. When it is said that the whole shaft of the bone is necrosed, the articular extremities are excepted; they remain unaffected, and throw off therefore the dead portion. A line of demarcation forms where the dead bone terminates, disintegration and absorption take place, the living bone throws out granulations, and complete separation of the living and dead structures is effected.

The *sequestrum,* as the dead portion of bone is called, acting as an extraneous body, stimulates the surrounding parts, and causes them to effuse a quantity of lymph, which, in a short time, becomes converted into cartilage; ossific depositions take place in this cartilage, and the whole is soon converted into a scabrous shell of bone, perforated generally by a number of openings for the exit of the pus and earthy matter dissolved in it; for it will be found that necrotic pus contains a large quantity of phosphate of lime, while in healthy pus, *pus laudabile,* scarcely a trace of bone-earth can be detected.

In these cases you will find injections of phosphoric acid diluted with an equal weight of water, useful in facilitating the removal of the sequestrum, converting the phosphate into a bi-phosphate of lime, which is much more soluble, and more readily acted on by the pus. I know it is the opinion of some authors that pus does not possess the power of dissolving bone, and they have quoted experiments in proof of their opinions: such as placing pieces of bone of known weight in pus and abscesses, and afterwards weighing them, without, as they say, being able to detect any loss. Such an experiment is, however, quite worthless; it must be remembered that the bone in necrosis is in an abnormal condition, and probably more attackable by any solvent than natural bone; moreover, the pus, which acts as the solvent, is as it were in a nascent state, is developed in the tissue of the bone, and is, therefore, placed under circumstances much more favourable to such chemical change. The fact that necrotic pus does contain an abnormal quantity of phosphate of lime, is easily proved by a very simple examination, and it seems to me that it is only a fair deduction to suppose that the excess of earth is obtained from the bone, in which the vital influence no longer exists to protect it from ordinary chemical action.

When the sequestrum is removed, either by force or by the process of absorption, the living extremities of the remaining bone throw out granulations which fill up the space within the provisional shell, and as the new matter becomes converted into permanent bone, the provisional bone begins to be absorbed, and is ultimately entirely removed. The same process takes place in the union of a fractured bone, so that in either case it must not be supposed that reparation is perfected because a patient is capable of sustaining the weight of his body on a limb which has been the subject either of necrosis or fracture; several months may yet be required for its perfect consolidation.

The constitutional treatment, during the progress of the death of bone, depends upon the peculiarity of the constitution of the patient, and the circumstances which induce the exfoliation. Usually, antiphlogistic remedies are at first indicated; and the investment of the limb in splints may be required, to maintain the bone in a perfect state of rest; the recumbent position must also be strictly enjoined. Sedatives, combined with small doses of mercury, are generally required, as well as tonics to sustain the powers of the patient. If the disease depends upon syphilitic taint or malignant diathesis, the appropriate remedies will naturally suggest themselves to the surgeon.

When the sequestra are large, they may require to be removed by operation, as too much time would be occupied in dissolving them by means of acids, and the continued purulent discharge would exhaust the patient's constitutional powers. Before an operation is, however, undertaken, you should be fully satisfied that the dead bone is perfectly loose; this may be ascertained by examining it with a probe, and by the extent of its mobility. Having ascertained that it is fit for removal, the object may be effected by cutting down through the soft parts to the bone, so as to lay bare an aperture in the new shell; and if this opening be not sufficiently large for the extraction of the sequestrum, it must be enlarged by a small saw, trephine, or chisel, so as to admit a pair of strong forceps to seize the dead bone and draw it out. Sometimes it may be requisite to use a pair of cutting bone-nippers to divide the sequestrum into smaller portions, so as to remove it piecemeal; but this will only be necessary when a large portion of the shaft of the bone has become necrotic. When necrosis has extended to the articular extremity of a bone, and a joint becomes implicated, and when, at the same time, the powers of the patient have become exhausted by suppuration and protracted suffering, amputation of the limb is necessary, and care must be taken that, from anxiety to save the limb, life be not endangered by too lengthened an attempt to cure the disease. It is to be borne in mind that the diseases of the bones of the upper extremities are more readily cured than those of the lower; so we find, also, that our prognosis in fractures is much more favourable when the injury is inflicted on the bones of the arm than of the leg, and the same law holds good with respect to injuries and diseases of the soft parts, which evince a higher degree of reparative power in proportion to their proximity to the heart's action. This fact may perhaps be considered to apply only to those effects of inflammation uninfluenced by malignant or specific constitutional derangement; for if the blood has become deteriorated by a specific morbid action, we should be inclined to believe that the progress of the disease would be more rapid as its situation approached the source of its nutrition.

LECTURE XVII.

MALIGNANT DISEASES OF BONE.

Malignant diathesis—Characteristics of malignant disease in bones —Osteo-sarcoma—Generally attacks cylindrical bones and lower jaw—Treatment—Cases.

Medullary sarcoma—Probably identical with fungus hæmatodes of the soft parts—Characteristics—Disposition to return—Cases —Melanosis—Black colour arising from effusion of blood —Malignant character of melanosis—Case—Fibrous sarcoma —Sometimes attacks the bones of the head—Case—Scirrhous tumour.

Cystiform sarcoma—resemblance to fungoid disease—Hydatids in bone—Case.

The diseases which I have described as incidental to bone, may arise from mere local causes, and pass through all their stages without producing serious constitutional derangement; there are diseases, however, which depend wholly upon constitutional deterioration, and these will form the next subject for consideration.

Under certain circumstances, mere external injury may set up a general inflammatory action in a bone, and this may become a malignant disease, owing to the peculiar diathesis of the patient. It may naturally be inquired what is meant by malignant disease; I acknowledge it is difficult to answer the question correctly.

A malignant growth has been defined as "the development of an element which has an indefinite tendency to increase until checked by ulceration or slough; and which when removed is liable to return, and to be propagated to different parts of the body, through the medium of the absorbents." These are conditions which evidently depend wholly on constitutional, and not local causes.

Exostosis, as I have already said, is a disease which usually results from some slight local cause, and is productive of no harm, unless the bony growth interferes with the surrounding tissues; but if this primary action occurs in a person with a malignant diathesis, the exostosis becomes converted into a malignant disease, which is termed osteo-sarcoma; the adventitious growth is no longer composed of the constituents of healthy bone, but new elements are eliminated from the blood, which are unfitted for the nutrition of the tissues in which they are deposited.

Osteo-sarcoma is a degeneration of bone into a substance of a peculiar structure, softer than bone, but still not having the character of flesh. This alteration of structure is at the same time attended by the deposition of a new material, so that the disease is marked by increase in the size of the affected bone to a greater or less extent. Although undoubtedly a malignant disease, and remediable only by the knife, it does not appear identical either with cancer or fungus hæmatodes, as it has less disposition to contaminate the structures in its neighbourhood, and is rarely propagated to other parts by means of absorption. The disorder appears to attack persons of all ages, but is probably more common in youth than at an advanced period of life; it usually commences from the periosteum, and consists of a substance resembling cartilage, interspersed with spicula of earthy matter. If a section be made of the tumour, it will frequently be found to exhibit numerous irregularly-formed cavities, containing a red-coloured inspissated fluid. The osseous plates intersect the tumour: they are sometimes found to take their origin from the cancellated structure of the affected bone, as if originating in the medullary membrane, but are more frequently found between the periosteum and the bone. Osteo-sarcoma increases very rapidly, and if it originates in the exterior surface of the bone, is not attended with much pain, but grows insidiously to a great size, causing little or no inconvenience beyond the interference with the surrounding structures; if, however, it commences from the interior of the bone, great pain is experienced until the compact structure of the latter has become absorbed or ulcerated.

An osteo-sarcomatous tumour is firm but somewhat elastic to the touch; when small it is generally spherical, but as it increases in size its surface becomes unequal and lobulated.

The ilia are said to be most frequently affected with osteo-sarcoma; the disorder usually arises near the acetabulum; the cylindrical bones and the lower jaw are also often attacked by this disease, but rarely the bones of the cranium or spine; these seem to be more disposed to the fungoid or medullary sarcoma.

We know of no cure for osteo-sarcoma; but as it depends upon constitutional deterioration, it is among constitutional remedies alone we can hope to discover an antidote. Iodine, arsenic, mercury, bark, and every kind of alterative and tonic, have been tried; but in vain. Amputation seems to be the only resource, and this operation should be performed so as to remove the whole of the bone which is diseased. If, for instance, the disease be in the tibia, and even close to the ancle, I should always recommend that the amputation be performed above the knee; for although there does not seem to be the same liability to the return of the disease when attacking bone as when seated in the softer structures, still I feel convinced of the greater safety in amputating above a joint, so that the bone sawed through may have been perfectly isolated from the diseased bone by the structures of the intervening articulation, all of which are less susceptible to the development of malignant action, than the osseous system itself.

Before amputation of the limb be determined on, we must examine whether or not the disease has extended itself; for if the glands in the groin or axilla have become enlarged, indicating malignant contamination, it would be cruel and useless to expose the patient to the operation, as it would be quite unavailing under such circumstances.

I have lately had a case in which the upper part of the right femur was enlarged to three times its natural size, and this adventitious growth commenced without any assignable cause, excepting a slight sprain in attempting to raise a heavy weight; its growth was very rapid, and unattended with pain. But still no one could look in this man's face without perceiving that he was very much out of health; he presented all the indications which are supposed to mark a malignant diathesis. The tumour was hard, of a rounded form, and seemed as if it overlapped the femur; at one part it yielded somewhat under pressure, and might be said to be slightly elastic. The skin was not discoloured, beyond slight venous congestion, and enlarged veins could be seen crossing the tumour.

There was no enlargement of the inguinal or lumbar glands to show general malignant taint, and therefore I recommended the patient to submit to amputation of the limb at the hip-joint; he consented at the time to have the operation performed; but before the moment arrived his courage failed him, and he left the hospital.

In 1834, I was consulted by a young man, 17 years of age, who had a swelling on the left humerus, which had acquired the size of an orange. It produced little or no pain, but interfered with the motions of the elbow-joint, obstructing the action of the flexor muscles. The tumour was round, presented an even surface, and was slightly elastic to the touch. I saw this case with Mr. Saunders, of Cheshunt, and, after I had examined the tumour, proposed to strip off the periosteum, with the intention of depriving it of nourishment, and leaving it to slough. On exposing the tumour, however, I found it to be almost entirely cartilaginous, and I therefore proceeded to remove it by slicing it off from the bone: its osseous deposits offered but little resistance in the operation. The wound was a long time healing, but the patient ultimately recovered; and I have no reason to believe that the tumour ever returned, although the general health of the youth certainly evinced a malignant tendency. There may be some question whether this was not a case of simple exostosis not yet converted into bone; but from the appearance of the cartilage I removed, and from the constitution of the patient, I was induced at the time to consider the disease malignant. I believe osteo-sarcoma less liable to return than any other of the diseases termed malignant, but still I would urge that it is judicious, whenever amputation is considered necessary, to amputate on the proximal side of a healthy joint, so as not to leave any portion of the bone which had been affected.

Medullary sarcoma is but a variety of this disease. It most frequently commences in the cancellated structure of the bones, usually attacking the articular extremities, and the spongy bones. It is, in my opinion, the same disease as fungus hæmatodes of the soft parts, and occurs in a similar manner to that disorder, chiefly at the earlier periods of life. At the commencement of medullary sarcoma, it is extremely painful, from its being seated in the interior of the bone; but as its growth is very rapid, it soon makes its way through the bone, and then the patient becomes comparatively easy. The progress of the disease is much more rapid than that of fungus hæmatodes of the soft parts; sometimes, however, it seems to remain quite stationary for a while, and then its growth suddenly recommences and goes on more rapidly than before; in other cases it grows steadily and rapidly from its very commencement, and so quick is its progress in some instances that I have heard of a tumour being removed from the lower jaw, which had gained the weight of four pounds in eight months. Shortly after the commencement of the disorder an external tumour appears; whilst this is small the skin retains its natural appearance, but is sometimes pale and glassy, and seems to be stretched over the abnormal growth; as the tumour increases in size the skin becomes discoloured, changing to a purplish red, and numerous dark veins traverse the surface of the tumour just as is seen in fungus hæmatodes of the soft structures, the skin soon becomes inflamed, and ulcerates, when a soft, dark-coloured fungus protrudes, having a great tendency to bleed. The protruding mass is usually lobulated, composed of rounded masses of brain-like matter, which readily break down, and are so highly vascular as to bleed upon the slightest touch. The tumour usually presents points of dark-coloured depositions like portions of coagulated blood, from whence the disease has been termed hæmatoid. At this period the diseased structure increases with great rapidity, and frequently pulsates, from the size of the vessels which supply it. If caustics or any other means be employed to check its growth, its size may be diminished for a short time, but it soon begins to grow again with increased vigour, and baffles every attempt at its removal.

The pulsation of such tumours is an important circumstance to be remembered. I have known this disease more than once mistaken for aneurism, and was once present when the common iliac artery was tied for what was considered to be aneurism of that vessel, but which afterwards proved to be a fungoid tumour, situated in the pelvis: even had the true nature of the disease been recognised, the tying of the artery could not have been considered bad practice, as it supplied the tumour with blood; and tying the chief vessels of the tumour has been recommended and practised as a means of checking the morbid growth. The result of these cases has, however, only proved the futility of such a view. Sir Astley Cooper and Mr. Lucas both performed this operation some years ago at Guy's Hospital, but ineffectually.

Medullary sarcoma is a disease of the most malignant character, and, when removed, is almost certain to return. If amputation be resorted to, a healthy joint should always, if possible, intervene between the disease and the point at which the amputation is performed; but even this precaution does not insure a successful result.

Eliz. Cousins, æt. 19, single: was admitted into Guy's Hospital on the 17th of May, 1843, under my care, for an enlargement in the middle third of the right humerus; the swelling was most prominent on the outer and posterior part of the arm. Her general aspect was pale, and her frame somewhat emaciated: in short, there was every indication of what is termed a malignant diathesis. Three years before, she had an abscess in the left axilla, which, on being opened, quickly healed. Her friends described her as being quite free from hysteria, but her manner certainly manifested an hysterical tendency. She dated the commencement of the present disease eighteen months previous to her admission into the hospital, and stated that the first symptom was a peculiar gnawing pain, like rheumatism, extending from the shoulder to the right hand. These symptoms continued until about six weeks before she came into the hospital, when the upper arm began to enlarge, especially about its centre: the pain now increased to a great degree, particularly at night, so that her rest was broken; at the same time, the tumour continued to enlarge until it had acquired the size of an orange.

On examination, the tumour afforded to the touch a firm and uniform hardness, with slight increase of pain when pressed. The bone above and below the swelling did not appear to be implicated in the disease, but she complained of aching pain along the forearm. The glands in the axilla were slightly enlarged; the integuments covering the swelling were healthy.

After a careful examination of every circumstance connected with the case, I came to the conclusion that it was a malignant disease of the bone, and that the only chance of saving the life of the patient was by amputating the limb at the shoulder-joint, I considered this preferable to sawing through the diseased bone, although there was sufficient space to have allowed it.

On the 23rd of May, I performed the operation, and on the 3rd of July she left the hospital, having no other unfavourable symptom than a slight dragging of the left leg.

In the November following, she was re-admitted into the hospital for a tumour on the left scapula, having a similar appearance to that on the right arm, for which the amputation of the limb had been performed. The tumour gradually increased in size, reaching to the upper part of the dorsal region of the spine. After having experienced for a day or two great pain in the lower extremities, they became paralysed, and she was incapable of voiding her urine; but soon after, incontinence of urine supervened, with torpor of the bowels. She complained of cough and pain in the right hypochondrium, extending to the pit of the stomach. There was dulness on percussion on the right side of the chest, and she discovered a small hard tumour on the sixth rib of the right side. All her symptoms became aggravated, she grew weaker every day, and on the 24th of January, 1844, she died.

Post-mortem examination, forty hours after death.—A large fungoid mass was found occupying a great extent of the right cavity of the chest, and the medullary tumour growing from the left scapula extended to the posterior part of the vertebral column, pressing principally upon the second dorsal vertebra, the arch of which was forced inwards so as to compress the spinal marrow, and produce the symptoms of paralysis. The medulla spinalis appeared quite healthy, with the exception of compression at the point above mentioned. Some unforeseen circumstances occurred during the amputation at the shoulder-joint, in consequence of the admission of air into the veins. I do not give the details, because the subject is irrelevant to my present object; but the whole case is published in the ninth volume of the second series of the *Medico-Chirurgical Transactions.*

A Mr. P——, the principal manager in a large brewery, consulted me with a tumour on the left leg, which, he said, had baffled every attempt to cure. As soon as I saw the tumour, I suspected its malignant character, as I found it composed of distinct lobes of medullary masses, having a great tendency to bleed, growing rapidly, and producing little or no pain. Concomitant with these local symptoms there was great constitutional derangement, and a general malignant aspect. My impression was, that the safest plan would be to amputate the limb above the knee; but, as the patient seemed so perfectly unconscious of any danger from what he considered simply a sore leg, I proposed to him a consultation with another surgeon, and expressed a wish that some of his friends should be with him at the time of our meeting. The late Mr. Tyrrell was the surgeon whom he chose to meet me, and it was his opinion that it would be advisable to try the effect of the extirpation of the tumour; as, should the disease return, we could then amputate the limb. I conceded to Mr. Tyrrell's views, and, at the earnest desire of the patient, consented to follow the proposed plan. I removed the disease completely from the bone, and we were all gratified at the rapidity with which the wound healed, by apparently healthy granulations and perfect cicatrization.

In about three months, however, Mr. P. returned to me with a similar tumour making its way through the cicatrix. I therefore urged upon him the necessity of immediate amputation of the leg above the knee; but he said he must take some time to think of it, and would let me know his determination. I warned him against delay, from the fear of the inguinal glands becoming affected, which would render amputation useless.

I, however, heard no more of my patient; but, in about a fortnight after, I was driving past his residence, and saw a surgeon's carriage at his door; the house was shut up, as if death had been busy within; and this indeed proved to be the case: the limb had been amputated, and the patient died three or four days afterwards. Upon a post-mortem examination, fungoid disease was found in several parts of the body.

The characters of this disease are all well defined. The existence of pain as the earliest symptom,—the relief from pain as soon as a tumour appears,—the rapid growth of the swelling, quick ulceration of the skin, lobulated form of the tumour,—its liability to bleed,—frequently pulsating,—and also its great tendency to be propagated in distant parts,—render the diagnosis comparatively easy.

Melanosis is the name given to malignant development in the living structures, when it is characterized by a black colour, and it has sometimes been found, if not in the bones themselves, complicated with the diseases of the osseous system. It is, I believe, a form of fungus hæmatodes, in which there is a peculiar "pigment cell" degeneration, in consequence of the low vital powers of the constitution of the patient. It has been considered by some pathologists as a disease of the rete mucosum; but just as we find in health inflammation that leads to the effusion of lymph, which becomes organized, and that in a bad constitution we have pus formed,—so, under still greater constitutional derangement, a sanious discharge is effused. Thus in fungus hæmatodes the elements developed differ according to the degree of constitutional deterioration; and in the worst cases this melanotic disposition results, indicating a highly cachectic and malignant diathesis.

A young lady, about 20 years of age, came to town upon a visit from the country, and it was noticed by her sisters that she walked rather lame. On being asked the cause, she said that it was nothing of importance, but that she had a small black spot on the instep of her right foot. Her father with some difficulty persuaded her to take the opinion of a surgeon upon the subject, and brought her to my house. On examining the tumour, I told the father my opinion of the dangerous nature of the disease, but recommended him by all means to consult Sir Benjamin Brodie, as I saw that he could not be induced to believe that so small and painless a spot could be so alarming as I represented it. Sir Benjamin Brodie agreed with me as to the nature of the disease, and I amputated the leg above the ankle-joint, having first ascertained that there was no enlargement of the inguinal glands. The stump very quickly healed, but in a very short time (about a month after the limb had been removed) the patient came to tell me that a swelling had formed in her groin, and in three weeks from that time this swelling proved fatal. I have seen melanotic spots in the pectoral muscles of patients the subjects of malignant diseases of the breast, and in all these cases, the disease, when removed, rapidly returned, and proved fatal. I believe that melanosis is the worst form of fungus hæmatodes, and not a disease *sui generis*.

Fibrous sarcoma.—This disease presents nearly the same physical conditions as carcinoma, and I am quite sure, that if we saw a fibro-sarcomatous tumour of a bone in a patient who was at the same time the subject of carcinoma, we should at once say that the affection of the bone was a scirrhous disease; but as it frequently occurs without carcinoma of the soft parts, it is, singly, termed a fibrous sarcoma.

The tumour, if cut into, consists of a hard, white nucleus, gencrally attached to the periosteum, and having fibres radiating from its centre; if this swelling be extirpated, it may return in the same situation; but it does not seem liable to be propagated by the absorbents, which circumstance perhaps has led to its being separated from cancerous diseases of bone.

The fibrous tumour has a tendency to increase in its size still more rapidly than osteo-sarcoma. It is attended with darting pain, like scirrhous disease, and often leads to the absorption of the bone from which it grows; it sometimes attacks the bones of the head.

I was consulted some few years ago by an Irish judge on account of a tumour on his head. Upon examination, and from its history, I thought it was a common encysted tumour, rendered harder than usual from the pressure of the wig; it was not so moveable as encysted tumours generally are, and I did not expect it to turn out very readily. Having made an incision through the scalp, and passed my finger into the wound to detach the cyst from the subjacent structures, I was surprised to find the parietal bone absorbed, and the dura mater exposed, and from this the tumour was growing. I detached the disease, and brought the edges of the skin together, and at the same time explained to the patient the nature of the case, so that he might employ due precaution for the defence of the exposed portion of dura mater. The wound readily healed, and the patient perfectly recovered, and lived many years after, without any return of the disease.

These tumours have not a great tendency to return, but nevertheless I think they are malignant; indeed scirrhus itself, in some of its forms, will remain dormant for years if not interfered with.

Scirrhous tubercle in bone is of rare occurrence, and, I believe, invariably a secondary disease;—by this I mean that it is concomitant with cancer of some other structure of the body. When it occurs in bone, it presents a hard, white tubercle, somewhat fibrous, and resembling very much the fibrous sarcoma just described. Sir Astley Cooper extirpated the mamma of a woman, and some few months after she broke her arm by merely turning in bed. She survived the accident but a short time; and upon examining the body, a large scirrhous tumour was found in the substance of the humerus. Had this patient not been the subject of cancer of the breast, I have no doubt that the disease would have been considered fibrous sarcoma.

In young persons, the fungoid diseases more frequently attack bones, and develope themselves primarily in the osseous system; scirrhus is a much rarer disease in bone, and, as I have said, is invariably a secondary affection. From these circumstances, a diagnosis of the two diseases may be formed.

Cystiform sarcoma.—The description of this disease might perhaps more properly have preceded that of the malignant affections of bone; but I have followed the order of Sir Astley Cooper's arrangement, who nevertheless has, in my opinion, mis-named this malady under the appellation of hydatid disease. Cystiform sarcoma generally attacks the epiphyses of bones, constituting a number of small cysts, in which a fluid is secreted. It bears a very strong resemblance to fungoid diseases, which are always more or less cystiform, but generally the cysts are less distinct. The form of the vesicles, however, may depend upon the structure of the bone; for as soon as the osseous cells are broken through, the disease puts on every appearance of fungus hæmatodes, and, like it, is very liable to be propagated through the medium of the absorbents to remote parts of the body.

The progress of cystiform disease in bone is generally slow; in some few cases, however, an immense cystiform growth has taken place in a few months, but it is not generally so, and not unfrequently the disease will remain stationary for years. In the early stage of development, the prognosis in cystiform disease of bone is favourable, if in its extirpation care be taken to remove the whole of the implicated parts; but when once the cancerous degeneration has set in, the operation, as in other malignant diseases of bone, is quite useless.

A very rare variety of cystiform disease is that in which hydatids are contained in a fluid occupying the cyst.

Any tumour containing fluid in a cyst seems to have been termed an hydatid tumour, but what I mean to describe under the name of hydatid disease in bone, is the development of the living entozoa within the osseous structure. This is truly a rare disease, but it occurs in bone as well as in other structures of the human body. Sir Astley Cooper, Mr. Keate, and Baron Dupuytren, have written on the subject. The diagnosis is extremely difficult, as there are no well-defined symptoms indicating the presence of the animalculæ, beyond the pain and irritation in the affected bone, which might equally arise from any other cause; neither is there any peculiar constitutional sign of their presence upon which a diagnosis can be established. This disease is most likely to be mistaken either for abscess or necrosis, and cases are recorded where bones have been trephined for the purpose of evacuating pus, and hydatids were found to be present.

Mr. Keate has given the history of a case in the 10th volume of the *Medico-Chirurgical Transactions,* in which hydatids were removed by surgical operation from the frontal bone, although the nature of the disease was not known until the outer table of the bone was removed with a saw, when the hydatids made their escape, and the patient recovered. Sir Astley Cooper had a patient under his care, a lady, who broke her arm from some very trivial cause, and the bone did not unite; great constitutional irritation followed, and she sank under the infliction. On a post-mortem examination, it was found that several hydatids were embedded in the humerus, in a large cavity which had, in fact, led to the fracture of the bone merely from muscular action. A preparation of this humerus is preserved in the Museum at Guy's Hospital.

M. Cullerier describes a case in which a patient was the subject of an indolent tumour on the anterior part of the upper third of the tibia. It was considered steatomatous, but presented an osseous boundary, as if the tumour had sunk into the bone. Caustic potash was applied, and on the separation of the slough there issued forth a thick matter. On examination of the bottom of the cavity, an enlargement of the tibia was detected; actual cautery was had recourse to, which produced an opening into a cavity whence escaped numerous small round bodies, of three or four lines in diameter, and one more than an inch in diameter, containing several others within itself. These bodies were hydatids, of the nature of those termed acephalocysts.

This disease is not to be classed in the category of cystiform tumours, which are merely rounded vesicles containing elements of different characters, depending upon the peculiarity of the constitution affected, and without possessing any independent vitality.

The hydatids are living entozoa, being capable of motion, nutrition, and propagation; but the cause and mode of their development are perfectly unknown.

I have myself found them in several situations in the body, but nothing in the appearance of the patients could have led to the suspicion of the nature of their complaint.

In the removal of tumours which contain hydatids, great care should be taken to extirpate the whole of the cysts in which they are contained, as the smallest portion, if left behind, seems to create great constitutional disturbance; I believe that, with every precaution, however, the wound can never be made to unite by the adhesive process.

LECTURE XVIII.

FRACTURES OF BONES.

Formation of bone—Its organic and inorganic constituents—Progress of its growth—Structures destined to its formation—Progress of reparation after fracture—Difference between simple and compound fracture—Fractures in general—Of the bones of the cranium—Seldom occur without injury to the brain—Concussion and compression of the brain—Symptoms—Treatment—Hernia cerebri—Methods of removal—Caution requisite in the application of the trephine—Case—Powers of nature to accommodate the brain to abnormal circumstances.

Growth and reparation of bone.—Before I speak of the process of inflammation necessary to the reparation of bone, it will be necessary to take a cursory view of the formation of healthy bone. The hardness which forms the characteristic property of bone frequently leads us to regard the osseous system, and the phenomena attending the diseases incidental to it, as removed from the vital influences exerted on the softer structures, while, in fact, the same laws and actions preside in both instances.

At the earlier periods of uterine gestation there is no appearance of the rudiments of the future osseous system, both it and the other animal structures constituting a membranous mass, containing a soft gelatinous fluid matter.

About the ninth week, in those parts of the body which will be early required to perform functions in which strength and solidity are necessary, cartilage is found to be deposited, and soon after, earthy matter is also eliminated from the blood.

Thus it is to be observed that the osseous system is not completed at once, but progressively. Yet this progression cannot be said to proceed entirely in the order in which the parts will be required for use, but seems to depend somewhat upon the quantity of earthy matter which each bone contains when it has reached its perfect state.

Even for years after birth there is an evident progressive development of bone; and it will be observed, on examining the fœtal bones, that the progress of ossification seems to be influenced by the period at which they will be called into use, and require strength to enable them to perform their proper functions.

Thus we find the bones of the upper extremities are sooner developed than those of the lower; the vertebræ of the back and loins sooner than those of the neck. The clavicles, ribs, and sternum are nearly completed, while the ossa innominata are still cartilaginous. We find, moreover, that different parts of the same bone are progressively developed, as is seen by the later ossification of the epiphyses of the long bones than of their shafts.

Before we speak of the various structures implicated in the reparation of bone, we should examine those which are concerned in its original formation. Under the influence of the formative stimulus—the "stimulus of necessity" of John Hunter, the bloodvessels become actively congested, simulating in some respects inflammation, differing perhaps only in there being a diminished instead of an increased motion of the blood. An effusion takes place through the coats of the vessels into the cellular tissue, which becomes condensed so as to constitute a basement membrane for the future deposition of bone; but still the progressive steps are slow. First, gelatine, then cartilage, and, lastly, earthy matter, are deposited. Considerable difference of opinion exists, however, on this subject, more particularly with respect to the tissues employed in the process of bone formation. By some, the periosteum is supposed to be the principal agent in the deposition of the earthy matter, while to the medullary membrane is attributed the formation of the animal portion of the bone.

Duhamel considered periosteum as the principal source of the nourishment of bone, and formed his opinion from the manner in which he found the colouring matter of madder deposited in successive layers, in the bones of a young animal fed with that substance; but there can be no doubt that interstitial growth is constantly going on, and, indeed, in young animals the colouring matter of madder seems to be as quickly deposited in the interior, as on the cortex of the bone.

Haller and others have thought that the growth of bone in reparation proceeded from the medullary membrane and extremities of the fractured bone; and this seems to be the fact, so far as relates to the formation of the definitive bone. Larrey and his followers attributed the formation of the new bone to the animal structure of bone, and, with reference to the increase in length, this seems to be the case; for, in the original formation of bones, they cease to increase in length as soon as the shaft is ossified up to the epiphyses.

Dupuytren maintains that the surrounding tissues are the agents employed in the production of new bone, as is the case in the formation of the provisional bone which performs the office of placing the fractured ends of the bone in a position to re-establish their own continuity; but such bone differs from the ultimate osseous deposit, and is subsequently absorbed.

It appears to me that the external and internal periosteum, with their connecting cellular tissue, bear strict resemblance to the cellular neurilemma of a nerve, the membranous covering, the sarcolemma of a muscle, and the parenchyma of the various viscera, each being for the same purpose—that of forming a nidus, a "basement membrane," for the products eliminated from the blood under the unknown influence of the vital principle.

That the medullary membrane is essential to the growth of bone, may be proved by destroying it in the bone of a living animal, when the inflammation which is consequently set up immediately extends to the external periosteum, showing their intimate connexion: from this we may infer, that we cannot divide the membranous apparatus of bone into parts differing in function, but that the formation of the osseous system depends upon the reciprocal action or co-operation of the whole. It is true, that, in the formation of separate bones, there is a difference in the arrangement of the membranes: thus, in the flat bones, the cellular connexion between the external and internal periosteum leads to that arrangement of osseous deposit which is termed the diploe; while in the irregular bones, it is spongy, and in the shafts of long bones a solid compact deposit is formed. Therefore, it cannot be considered that any one part, but the whole of the membranous apparatus, is intended for the formation and reproduction of bone.

If a bone be broken, the first action which ensues is the effusion of blood, filling up the spaces between the fractured extremities, and even the lamellæ of the bone itself. The compact part of the bone not being so vascular, cannot pour out the same quantity of blood as the softer parts; a circumstance which may have led some physiologists to the belief that the internal periosteum has more to do with the growth of the bone than the external; while the truth is, that the circumstance depends upon a physical, and not a vital principle, namely, its greater density. It is supposed by some that the effused blood is wholly absorbed; by others, that the red particles alone are removed, and that the fibrin becomes organized, assisting in the process of reparation. On about the fourth day, inflammation is set up, commencing simultaneously throughout the whole extent of the periosteum; I mean the external, internal, and intermediate cellular tissue. This inflammation leads to the effusion of a gelatinous fluid, which continues to be thrown out for several days, becoming gradually firmer until it constitutes the callus, which in this state resembles in every respect the cartilaginous substance which the arteries of the fœtus deposit for the original formation of bone.

This cartilage is absorbed by degrees, its bloodvessels becoming evident, conveying red blood, and depositing the new bone in patches, and without any very apparent order. When a fracture is produced, either by accident or for experiment, so that the fractured extremities of the bone are not separated, a rim of callus appears formed around the fracture, between the external periosteum and the bone itself. Where the periosteum is extensively lacerated, the production of bone still goes on, partly from the denuded surface, and partly from the surrounding soft structures: so that the common cellular tissue is convertible into periosteum, or a substance capable of performing the same function, when in contact with the granulations arising from bone, which it cannot be until the periosteum has been destroyed. Thus, periosteum may be considered as not only useful in distributing bloodvessels for the nourishment of bone, but also as constituting the limit between the osseous and the other tissues. On this account it is that inflammation upon the osteal side of periosteum leads to the formation of bone, while on the muscular surface it terminates either in the adhesive or suppurative inflammation.

These different actions are distinctly demonstrable in cases of compound fracture, when the granulations proceeding from bone become covered by a periosteum, produced by the surrounding cellular tissure, and not till then are the granulations hardened into bone.

Having given an account of what appear to me to be the principles which regulate the processes of the reparation and original growth of bone, I shall now proceed to the description of fractures of different bones and their general treatment.

A *Fracture* is defined to be a solution of the continuity of a bone, resulting from a forcible extension disproportionate to and exceeding the degree of extensibility which it naturally possesses. Fracture is generally produced by the operation of an external force, but sometimes by a sudden and uncontrollable action of the muscles; it may be either *simple* or *compound.* A simple fracture consists in a solution of continuity in the bone only, without any external wound; while a compound fracture is attended with an external wound communicating with the fractured extremities of the bone. Simple fracture generally unites by adhesion, or what is termed by "first intention." Compound fracture unites by granulation, or secondary intention.

John Hunter made a still further distinction in the nomenclature of fracture: for instance, if, in a simple fracture, a wound through the soft parts subsequently resulted from pressure of bone, or from any other cause, he termed it a "*simple compound fracture;*" and when a wound of an originally compound fracture had healed before the bone had united, he designated this condition "*compound simple fracture.*"

Sometimes, in consequence of the inflammation resulting from the fracture, ulceration, suppuration, or death of the bone may follow. The same treatment is indicated under these circumstances as when the soft parts are similarly affected.

The peculiar structure of the injured bone must always be considered highly important, for the vitality of bones differs according as their texture is compact or spongy, and their liability to inflammation is in proportion to their softness: the harder or more compact bones are most liable to exfoliation; the object must always be to prevent this, if possible, by removing every source of irritation, but when death has occurred, all our efforts must be directed to facilitate the separation of the dead part. There is but little difference, therefore, in the treatment of the injuries and diseases of the bones, and of the softer structures of the body.

On fractures in general.—When a surgeon is called to a case of fracture, his mind is not only to be directed to the coaptation of the injured bone by mere mechanical rules, but there are important physiological circumstances essentially appertaining to the judicious treatment of such accidents; for instance, it should be remembered that the bones have been divided into flat, irregular, and long. This division does not merely indicate their figure, but leads to physiological and pathological considerations of the greatest importance. Thus, flat bones form cavities for the protection of important organs,—are united by articulations of a peculiar character, and are not influenced by the action of muscles. Hence, the surgeon has not to regard the injuries to these bones themselves so much as the safety of the organs contained within the cavities which they constitute.

In the irregular bones, the physiological view of the means to be employed for their reparation after injury, differs from the preceding, in consequence of their possessing greater vitality; and being consequently subject to a higher degree of inflammatory action, they require constitutional rather than mechanical means for their restoration.

The long bones are connected with each other by means tending to facilitate their motion; they are influenced also by numerous muscles; so that when they are fractured their broken extremities are separated more or less, and require mechanical means not only for their coaptation, but also to retain them in their proper position,—a difficulty greater or less in proportion to the number and size of the muscles attached to them.

The situation of the fracture in the long bones is an important circumstance; that is, as to whether the fracture be in the centre of the bone or towards its extremities. So also with respect to the position of the fractured extremities induced by the action of the muscles attached to them. This displacement may take place either laterally or in the direction of the length of the bone, according to the circumstances under which the fracture is produced.

FRACTURES OF THE FLAT BONES.

The bones of the cranium are connected with the important and vital parts constituting the brain and its membranes, being closely united to them by membranes, for their better support, and fracture seldom or ever happens to the cranium without injury to the brain or its appendages. The danger which arises from a simple fracture of the cranium depends, therefore, upon the degree of injury to the brain, and not upon the fracture of the bone itself. Hence these accidents are principally characterized by the symptoms arising from lesion of the nervous system. In severe blows upon the head, the consequence is generally either *concussion* or *compression* of the brain; and I must now proceed to the consideration of the symptoms in such cases, although they may occur without actual fracture of the bones of the head.

In cases of *concussion* the patient is stunned, the pulse weak and fluttering, the face pale, and the extremities cold; these symptoms occur immediately after the accident, and they continue until reaction sets in, when a new train of symptoms presents itself. The patient now remains in a half comatose state, with his senses weakened, but not lost; his power of volition suspended, but not destroyed. Respiration is generally tranquil, but sometimes stertorous, as when there is compression. If he be addressed loudly by name, he is capable of giving a rational answer, and, when thus roused, his pulse is found to increase to perhaps a hundred and twenty. The pupils have generally a natural appearance, and are capable of being stimulated by light: nausea and even vomiting are frequently concomitant symptoms.

Although what is termed concussion is a condition of frequent occurrence, but very little is known of the state of the brain which gives rise to the symptoms characteristic of the injury. Authors do not agree upon this point, and dissection of the brain of persons who have died from concussion, has not shown the cause of the symptoms; the brain does not present any signs of organic lesion, but Mr. Colles, of Dublin, states that in the cases he had examined it appeared to him that the brain was diminished in size, and that it no longer completely filled the cavity of the cranium.

Concussion has been divided into three stages—1st, depression; 2nd, reaction; 3rd, inflammation. The first is that state of insensibility which immediately succeeds the accident; the symptoms I have detailed are characteristic of this state. In the second stage the pulse becomes quicker and stronger, the body warm, and sensation is more or less completely restored; but the third or inflammatory stage is the most important.

The prognosis in cases of severe concussion is always unfavourable; when the shock has been considerable the normal state of the brain cannot be restored, and the patient often dies soon after the infliction of the injury. Sometimes even when reaction has taken place, nature seems unable to sustain her efforts at restoration, and the patient sinks, probably from want of power to maintain the circulation.

In *compression*, a complete comatose state is present, the senses and power of volition are entirely lost. The pulse is small, labouring, and hard; generally irregular, and sometimes intermitting. The pupils are dilated, and the retina insensible to light; occasionally one pupil will be dilated and the other contracted; and more rarely both will be contracted. There is, however, no symptom, either in concussion or compression, more difficult to estimate as a diagnostic mark than the state of the pupil. Contraction of the pupils is, I think, an unfavourable symptom, as it indicates destruction of the nervous influences of the eye, and consequently great degree of injury to the brain. The breathing is stertorous. When the injury is very severe, hemiplegia is sometimes present, most frequently on the opposite side to that injured; and sometimes, although rarely, the urine will be retained, whilst the fæces pass involuntarily. These various symptoms arise from pressure upon the brain, either from extravasation of blood, effusion of serum, or the formation of matter.

The symptoms of pressure on the brain are subject to vary much under different circumstances; sometimes the insensibility is complete, and the patient remains totally unconscious of external influences. At other times it is only partial, and cases are recorded in which only one particular sense, as that of vision, was affected; the circulation is always much influenced by compression, but perhaps less so than by concussion. Paralysis is a very constant symptom of compression; as I have said before, it generally manifests itself on the uninjured side, but many cases have been described in which the paralysis was greatest on the side which had received the injury. The extent of paralysis and that of insensibility seem to bear some relation to each other.

When the symptoms arise from depression of bone, they come on immediately after the accident,—and usually the irregularity on the surface of the fractured bone may be detected by careful examination: continued and firm pressure with the finger is necessary in order to ascertain that the apparent depression is not mere swelling of the scalp, which to an inexperienced practitioner communicates a feeling as if the bone were depressed; but which sensation gives way upon the force being maintained.

When extravasation of blood, or effusion of serum, occasions the symptoms of compression, they come on gradually after the accident; sometimes hours or days may elapse before they are fully developed, according to the size of the ruptured vessel, or the degree of subsequent inflammation.

Lastly, when matter forms, it is possible that even weeks may intervene previous to the accession of the symptoms of compression; and they are always preceded by a train of indications similar to those in the formation of matter in other parts of the body, such as pain and rigors, after which the symptoms occur, violent in proportion to the quickness and quantity of matter formed. Such symptoms lead to the necessity of surgical means for the removal of the matter. Sometimes, however, it is difficult to ascertain the situation of the pus; and puffiness of the scalp, easy separation of the pericranium, and the ashy colour of the bone, form the only marks by which the surgeon can be guided in the use of the trephine.

Too frequently the symptoms of compression from the formation of matter come on insidiously, unattended with pain; but the surgeon should examine the scalp with care, when he will find the seat of injury still marked by a puffy state. Where the scalp has been wounded, the subsequent formation of matter may be more readily detected from the edges of the wound becoming glossy, and the discharge thin and ichorous.

The inner table of the bones of the skull is sometimes fractured, while the outer remains entire; such an accident renders the diagnosis extremely difficult, because there are no external signs of the seat of injury; and should there be any contusions on the exterior of the skull, still the fracture may possibly be, upon the opposite side, resulting from what is termed *contre-coup*. The effects of such an accident would not become manifest until some time after the infliction of the injury, when an effusion between the dura mater and the inner table of the skull would produce compression of the brain, and subsequently a puffiness of the scalp externally, which would point out the seat of injury. In such a case, the dura mater is first separated, and secondly the pericranium; the converse, however, more frequently happens, the matter being formed externally to the bone; the pericranium is then first separated, and the dura mater subsequently: in either case, the train of symptoms which follows is precisely the same.

In the *treatment of concussion*, the first object is to wait for reaction; or, should collapse continue for an alarming period, and the patient remain in a state of insensibility after warmth had been applied to the surface of the body, gentle stimuli must be administered, to hasten the reaction, even although there may arise from this treatment some danger of subsequent inflammation.

Sir Astley Cooper having observed that vomiting frequently preceded reaction, regarded it as an effort of nature to induce that state, and was in the habit of ordering an emetic in imitation of the natural indication. He found it to fulfil the object he desired; but I have always been afraid to follow his example, from the dread that the quantity of blood forced to the head in the act of vomiting would tend to produce effusion of blood in the brain: reaction being, however, established, either spontaneously, or by the use of stimuli, the next object is to control it; and to prevent inflammation from supervening, it used to be the constant practice to bleed after reaction had taken place, but I believe there are but few cases in which it is right to extract blood, and that mercury is a far better remedy, not only for the purpose of exciting an action in the bowels, but on account of its specific influence in checking the liability to inflammation in the membranes of the brain. Calomel is the most convenient form of mercury in these cases; and if the patient has any difficulty in swallowing a pill, five or six grains of calomel should be mixed up with a little butter, and placed on the back of the tongue with the handle of a spoon.

Should febrile symptoms supervene, the purging may be kept up by enemata of salts and senna; and if great heat or pain be experienced, cold lotions or a blister may be applied.

It is to be understood that this active treatment is not universally necessary, but may be required under certain circumstances; usually, however, in simple cases of *concussion*, I believe the less done the better. The tendency to coma is the state of all others the best adapted to maintain a state of rest and quiescence in the brain; and the surgeon should do all in his power to preserve this condition, by keeping his patient perfectly quiet. No one should be allowed to speak to him; the room should be darkened, and the diet of the most simple kind; and, when restlessness becomes an urgent symptom, I have found opium highly beneficial.

Under this passive treatment, the symptoms of pure concussion usually soon subside; but, even in the absence of all symptoms, perfect quietude should be maintained: for the very slightest excitement will often induce a relapse. The patient should still be kept low, and a more generous diet permitted only by the most gentle degrees.

I remember having a patient under my care in the female accident ward at Guy's Hospital, who had had concussion of the brain: the plan described had been strictly persevered in until the patient was considered by herself and friends quite convalescent; indeed, she complained of nothing but hunger. Her husband, who came to see her, brought her some eel-pie, which she ate, and appeared to enjoy her meal. The next day, however, she complained of headache; became feverish; in eight-and-forty hours had a rigor; then became comatose, with the pupils dilated; stertorous breathing followed; and she died of compression of the brain from the formation of matter. We should never be too hasty, therefore, in considering a patient out of harm's way after concussion of the brain.

I have already told you, gentlemen, that *compression* of the brain is distinguished by the loss of all consciousness, sensation, and voluntary power; while, in concussion, these are only suspended, and capable of being partially restored by rousing the patient. In compression the pupils are dilated, the respiration laborious and accompanied by a snoring noise, which is attributed to paralysis of the muscles about the palate and larynx, so that the air driven out of the lungs in expiration vibrates through the nasal fossæ; vomiting affords no relief, as in concussion: compression may, therefore, be readily diagnosed, (particularly when the symptoms come on immediately upon the infliction of the injury.) But the case may be more complicated: suppose a person receives a blow on the head, and is apparently only slightly stunned; from this he recovers, and walks for some distance; then suddenly staggers, and falls, with an entire loss of sensation and volition. Here we at once see that we have something more than concussion, the effects of which condition had subsided; and we should also know that if this were compression from fracture the symptoms would have occurred immediately upon the infliction of the injury: moreover, upon examination of the skull, no depression is to be discovered; there has also not been sufficient time for inflammation to come on, and therefore pus cannot be the cause of the compression on the brain. It is evident, then, that the symptoms are produced by extravasation of blood within the cranium, either between the bone and the dura mater, between the membranes and brain, or in the substance of the brain itself.

Suppose the surgeon to be called to such a case three hours after the accident has occurred, what should he do? This is a most important question, and one difficult to be answered. It is true we judge, from the history of the case, that extravasated blood is the cause of the symptoms, and we have reason to hope that by trephining the skull the cause of danger may be removed. This seems simple enough; but where is the trephine to be applied? There may or there may not be marks of violence on the scalp, showing the part which has sustained the injury: or, even if there be, it is not certain that that is the point at which the blood is extravasated; the effusion may indeed have taken place at exactly the opposite point of the skull, from the effects of "*contre-coup.*" I should not, therefore, recommend the immediate use of the trephine, but first the employment of strictly antiphlogistic means; bleed, purge, and apply cold to the head, and a blister to the nape of the neck. Should the symptoms not subside upon the treatment, and a distinct puffiness of the scalp exist, either at the part where the blow was inflicted, or at the opposite point of the skull, an incision should be made through the pericranium; and if that be readily separable from the bone, and the skull itself be dry, and of an ashy colour, it is pretty certain that the extravasated blood is immediately under the exposed bone, which should therefore be removed by the trephine.

The same appearance of puffiness of the scalp results when the extravasation of blood occurs between the dura mater and bone, in consequence of "*contre-coup,*" as the dura mater cannot be separated from the inner surface of the skull without the pericranium becoming detached at the same time; so that the external signs are precisely the same as when they result from an immediate blow on the scalp itself, excepting only that the puffiness from "*contre-coup*" is not an immediate, but a secondary effect. When the trephine has been applied, the opening may by chance be so directly over the clot of blood that the latter may be at once removed; but, should this not be the case, if the serum which has separated from the clot escapes, the brain is relieved from the pressure to which it had been exposed, and the operation may succeed. The trephine should therefore be used when the symptoms of compression have resisted all active antiphlogistic means, and when there is a tolerably certain guide to the exact seat of the cause of mischief, whether it be from depression of bone or extravasation of blood. When there is no such guide, and there is bleeding from the ears and nose, the case is a very forlorn one, as there is evidently fracture through the base of the skull, and the cause of compression is consequently beyond reach: you must, in such cases, endeavour to check further effusion of blood by bleeding and purging, and do all in your power to keep down subsequent inflammation by the exhibition of mercury. I have seen such cases recover; especially those in which bleeding from the ears was free, and a discharge of serum continued for some time after the accident, as it seems as if the discharge relieved the brain from the compression which must have resulted had not the blood escaped. Such a flow from the ears should therefore be encouraged, and care taken that its ready exit be not checked. There is also another cause which may render the application of the trephine proper—I mean when the formation of matter within the cranium causes pressure on the brain. This does not occur very soon after the accident, as the formation of pus must have been preceded by an inflammatory action, indicated by severe pain in the head and rapid pulse, intolerance to light and noise, and perhaps vomiting: with these symptoms delirium or convulsions may be combined, and a severe rigor marks the formation of matter. The dilated pupil, stertorous breathing, and coma, then show that pressure on the brain has taken place; and as soon as you have a guide to the situation of the matter, which is indicated by the same signs as when blood is extravasated, the trephine must be employed. I have seen matter removed by this operation upon two occasions; but although both of the patients derived immediate relief, in neither case did the treatment prove permanently successful.

In some cases of injury to the head, there is a combination of the symptoms of concussion and compression: thus, the blow which produces the depression of bone may also cause a concussion of the brain, the symptoms of which may go off after a time, and then the effects of the depression supervene. On the other hand, the effects of concussion may be such as to produce inflammatory action, and the consequent effusion of lymph or pus, which may compress the brain. Such cases complicate equally the diagnosis, prognosis, and treatment of the case.

Hernia cerebri.—This protrusion sometimes results from fracture of the skull, and perforation of the dura mater; or after the operation of trephining; more generally, however, it happens after compound fracture, in which the dura mater has been torn. I very much doubt whether these protruding fungous excrescences are really brain. I am inclined to consider them as exuberant granulations arising from the highly vascular pia mater, and that they protrude so readily in consequence of the perfect manner in which the cavity of the cranium is filled by the brain; so that when the dura mater is torn, these granulations immediately perforate the torn membrane, and, meeting with no resistance in that direction, constitute the tumour termed hernia cerebri.

Various methods have been adopted for the removal of these growths, and, among others, slicing them off has been recommended; this, however, I consider dangerous, from their great vascularity, and useless, from the extreme rapidity with which they grow again afterwards. Pressure is also dangerous, as it can only prevent the protrusion mechanically,—and in that direction, too, where alone it can take place with impunity: for, directly it presses upon the brain, symptoms of compression necessarily supervene. I believe the best treatment in these cases to be the application of some mild astringent lotion, to keep the head cool, and, by antiphlogistic means, to diminish the flow of blood to the part. The granulations which arise from the testicle after chronic abscess and ulceration of the tunica albuginea, resemble in every respect the exuberant granulations from wounded brain.

The following is a case of fracture of the skull, with hernia cerebri:—Michael Monyham, æt. 8, was admitted into Guy's Hospital with fracture of the cranium. The humerus and two ribs on the right side were also broken. The child had fallen from a window two stories high, and struck his head against an iron boiler. When admitted into the hospital he was breathing with difficulty, and there was a wound in the scalp three inches in length. Upon examining the wound, I discovered a fracture and depression of bone. As there were symptoms of cerebral injury, I enlarged the wound, elevated the bone, and removed some detached portions: the dura mater was wounded by the bone, and a portion of brain, with its coverings, protruded through the opening. After the operation the child became quiet and fell asleep; the pupils, however, remained dilated, and the pulse frequent. In the morning he awoke quite sensible, free from symptoms of compression, but with a frequent pulse and hurried respiration, and much unnatural heat about the head. He lay for ten days in much about the same state, but on the eleventh his symptoms became aggravated; the granulation from the brain had greatly increased in size, its surface being covered with a dark, ragged slough. He continued to get worse for the next three days, when he died. Examined after death: the tumour from the brain on the right side of the forehead was found to be sloughing; the bone through which it protruded was, to some extent, denuded of periosteum, discoloured, and separated by a distinct line of demarcation from the healthy bone; pus was found beneath the dura mater, running backwards from the abscess; the arachnoid membrane was perfect to the commencement of the fungus, where it was lost in the sloughing mass. A small quantity of pus was also found external to the arachnoid, in the left anterior lobe; a broken mass of red, brown, and curd-like matter, to which the fungus was connected, extended to the left ventricle, but did not open into it. A considerable quantity of pus lay between the arachnoid membrane and the brain, at the base, over the upper surface of the cerebellum and beneath the middle lobe of the cerebrum.

Sometimes the effects produced by injuries of the head are less urgent, loss of memory only resulting; the other intellectual powers remaining unaffected.

It is very curious to observe how this loss of memory is sometimes confined to events which occurred a comparatively short time before the accident. I remember a case of a Welsh woman, under the care of Sir Astley Cooper, who completely lost all knowledge of the English language, and spoke nothing but Welsh; but, as she recovered from the injury, she regained the power of speaking English.

The opinion of surgeons as to the conditions requiring the application of the trephine after injuries of the skull, varies extremely, some recommending its application prophylactically, while others consider its use as inadmissible, excepting under circumstances affording the most distinct evidence of physical pressure on the brain. I am of the latter opinion, and it is founded upon the experience of five-and-twenty years; nothing would induce me to use the trephine, whatever may be the extent of injury to the skull, unless symptoms of compression, which had resisted the administration of strict antiphlogistic remedies, were present. The following case illustrates very well the advantage of non-operative interference:—

George Marshall, æt. 28, was admitted into the accident ward, on the 6th March, 1837. Was a stoker on board a steam-boat, and whilst on duty on the 5th inst. received a violent blow on the face from part of the machinery. He was stunned for a few minutes, and profuse hæmorrhage from the wound ensued. He was not brought into the hospital until the day after the accident. There was a deep wound commencing over the left eye at the outer side, extending to the median line, dividing the middle of the nose, and reaching into the right cheek. The nasal processes of superior maxillary bones were fractured, and the frontal sinuses laid open. There were two or three spicula of bone over the eye; the parts were drawn down, so that there was a wide gap above the eye; the upper lip on the right side was divided; and the superior maxillary bone laid bare; the globe of the left eye was ruptured, and it presented the appearance of a rough, black, granular mass: there was also fracture near the vertex. The man was quite sensible, and did not complain of any pain. Pulse 80, and compressible.—Warm-water dressing was applied, and strapping laid over the right cheek.

7th.—Still free from pain, sleeps a great deal, and dreams. His bowels were freely evacuated in the morning; he was also very sick: pulse 70. He had some difficulty in passing his urine, but this he said he had had for some time. The fracture at the back of the head was about an inch and a half in length, and there was great depression of the bone.

8th.—Still going on much the same: pulse 80, and very laborious.

9th.—Was very restless last night, and complained of pain in the head; pulse 70, rather labouring; quite sensible, and talks rationally. His bowels have not been open since the 7th. Adhesion has commenced between the right side of the nose, which remains in its natural situation, and the left, which was depressed a great deal.

11th.—Complained of headache last night; pulse 80, gentle; going on generally much the same; the wound begins to suppurate. The warm-water dressing continued.

12th.—He was very restless last night; pulse 80; lips and mouth very dry and parched; the wound looks healthy, and is beginning to throw out granulations. He took calomel, gr. iij. and coloc. gr. v. yesterday; and after it, house medicine, which operated freely on his bowels.

13th.—He was again very restless in the night, but feels better this morning: has a little more pain in the back of the head. A spiculum of bone was removed from the wound to-day: there is another loose, but not sufficiently so to admit of its removal.

14th.—He still goes on much the same; was rather delirious in the night, but is better this morning.

15th.—Pulse 80, and gentle. Complains of slight pain across the left side of his head and eyebrow: was again somewhat delirious in the night. About this time he had an attack of erysipelas. Some pieces of bone were removed at different times from the wound. The erysipelas soon subsided; and no bad symptoms occurring, he rapidly regained his strength, and left the hospital about the middle of May.

The power of nature to accommodate the brain to a considerable degree of pressure, and to enable it permanently to perform its functions undisturbed, affords sufficient reason for waiting for symptoms before a piece of the skull be forcibly removed by the trephine. In cases of compound and comminuted fracture, where portions of detached bone can be observed, they certainly should be removed by dressing-forceps, or by means of Hey's saw; but if the piece of bone were firmly attached, and it could not be removed without the application of the trephine, I certainly would not use that instrument until cerebral symptoms indicated the necessity for the operation. The late Mr. Tyrrell removed, by the aid of forceps, the breach of a pistol-barrel from the skull of a boy, after it had been lodged within the cranium for some weeks. The boy perfectly recovered.

If we examine the history of injuries to the head, we shall find by far the greater number of successful cases have been those in which there has been the least surgical interference. But still, we should remember that where symptoms of compression exist, and continue, notwithstanding all our attempts to subdue them, there is no alternative, and we must employ the trephine, no matter whether the compression is caused by bone, blood, or pus.

LECTURE XIX.

CONTINUATION OF FRACTURES OF FLAT BONES.

Fracture of the bones of the face—Fracture of bones of the nose—Prognosis—Treatment—Fracture of lower jaw—Treatment.

Fracture of bones of the spine—Pathologically considered as flat bones—Vertebræ not easily broken—Diagnosis—Mode of examination—Symptoms—Treatment—Prognosis unfavourable in proportion to proximity to brain—Use of the trephine—Condition of the urine.

Fracture of the ribs—Pathologically considered as flat bones—Diagnosis—Appropriate treatment—Fracture of the sternum.

Fracture of the bones of the pelvis—Attention of the surgeon directed to the condition of the viscera—Fracture of the ossa innominata—Diagnosis—Treatment—Fracture of the pubes—Use of catheter—Treatment—Fracture of the sacrum and os coccygis—Case.

Fractures of the bones of the face, like those of the bones of the cranium, are chiefly important in reference to the organs of sense they enclose, and the object of the surgeon in such cases is to ward off or repair whatever injury they may have sustained.

The bones of the face bear a pathological relation to the flat bones, and, with the exception of the lower jaw, they, as the other flat bones, are immoveable upon each other, and unacted upon by muscles. These bones are occasionally broken. Generally speaking the prognosis is favourable; but in consequence of the contiguity, and, indeed, the continuity, of some of the bones of the face with those of the cranium, the brain may become implicated in the mischief; the surgeon should therefore be vigilantly alive to cerebral symptoms, and be prepared to combat them, should they arise, by the proper antiphlogistic remedies.

The *ossa nasi* are the most frequently fractured of the bones of the face; this results, no doubt, from their prominent position; they may be broken even to comminution without much displacement, or they may be driven almost flat upon the face: in the latter case the diagnosis is too obvious to be mistaken, but even if there be no displacement, the profuse hæmorrhage from the nostrils and the rapid swelling of the parts indicate the nature of the injury. When there is displacement, a pair of dressing-forceps (their blades well guarded with lint) should be introduced into the nostrils, and by depressing the handles so as to bring them in contact with the upper lip, the fractured bones can be elevated into coaptation, and they are generally easily maintained in the proper position; should it prove difficult, however, to keep the bones together, it may be effected by passing up the nostrils a piece of elastic gum catheter, surrounded by lint: this not only prevents the recurrence of the displacement, but at the same time tends to check further hæmorrhage, and the catheter being hollow it does not interfere with respiration through the nose.

Considerable swelling and inflammation usually supervene upon this accident; these must be subdued by the common antiphlogistic means, the activity of which must depend upon the constitution of the patient, remembering that the treatment is not only employed to prevent injurious effects on the tissues of the nostrils, but also to prevent the extension of the inflammation to the brain.

When compound fracture of the bones of the nose occurs, any detached portions should be removed, and the edges of the skin brought together by a very fine suture; the wound having been first well cleansed, to prevent the possibility of extraneous matter being left as a source of irritation.

The frontal sinuses are sometimes broken into by the force which produces fracture of the nose: if the scalp of the forehead remain intact, an extensive emphysema may result; while, on the contrary, if there be an opening through the skin, an escape of air will indicate the nature of the accident. In the first case, an opening should be made, to prevent the extension of the emphysema; but when the air escapes through the opening already made, little need be done beyond preventing the intrusion of foreign bodies into the sinus during inspiration. I lately admitted a patient into Accident Ward who had met with this complicated injury; he recovered perfectly under the mechanical and precautionary treatment I have explained. He escaped any cerebral symptoms; but had, however, some permanent deformity, in consequence of the comminuted condition of the bones of the nose.

Fracture of the *superior maxillary* bones, which are indeed united with all the bones of the face, excepting the lower jaw, require attention to prevent extension of the subsequent inflammation to the organs of sense which are enclosed within the cavities constituted by these bones. Comminuted portions of bone or any extraneous substance which might tend to keep up irritation must be carefully removed, and constitutional and local antiphlogistic remedies employed to subdue the inflammation inseparable from such an injury.

Fracture of the superior maxillary bone is always the result of a direct application of force; it has been produced by a violent blow on the chin, and by pressure on the chin and cranium. If it be produced by gun-shot wound, the local injury is usually great, and requires the kind of treatment indicated in gun-shot wounds generally.

It is, however, worthy of remark that these bones will sustain very extensive injury with little comparative constitutional disturbance,—a circumstance which tends to confirm the opinion of Adellon, that the interruption to the functions of the organs of sense interferes but little with vitality.

From the manner in which the bones of the face are articulated, their dislocation, with the exception of the lower jaw, is rendered impossible; therefore a force applied to these bones generally, may produce an extensive fracture implicating perhaps several of them. It is impossible to give any description of such a fracture, as of course it would depend upon the amount of force and its direction; the following case will give a better idea of the accident than a description of what may or may not possibly occur. I admitted a woman into Esther Ward who had been thrown down by a carriage, the wheel of which passed over her face, tearing off the whole of the integuments on one side, fracturing the orbitar process of the maxillary bone, the nasal bones, the bones of the palate, and the malar bone; but notwithstanding the great extent of the injury, the patient recovered without having manifested much constitutional disturbance; the treatment I adopted in this case I have found equally successful in many others of severe local injury. I suspended a bottle of water above the head of the patient, and passed a skein of cotton through the cork; it acted as a syphon, and maintained a constant dropping of cold water upon the injured part; the equable temperature thus obtained prevented the accession of inflammatory symptoms.

Fracture of the inferior maxillary bone.—Notwithstanding the prominent situation of this bone, it is less liable to fracture than would be expected, in consequence of its great mobility. When it is fractured, the attention of the surgeon must be directed to the best means of producing and maintaining the coaptation of the fractured portions; for as they are under the influence of powerful muscles, displacement and distortion offer prominent diagnostic marks of the nature of the accident, and a just knowledge of the action of these muscles is required, to enable the surgeon to adjust the fracture. The lower jaw may be the subject of fracture in any part of its surface, but the parts present some peculiarity of position according to the seat of the fracture, from the influence of the muscles attached to them; for instance, when the condyle is detached, owing to fracture through the cervix, the detached portion is drawn forwards and inwards by the action of the pterygoideus externus muscle, and the portion of bone being so small prevents any force being applied to replace it; it is necessary therefore, in order to produce coaptation, to force the whole of the jaw towards the condyle. In fractures through the ascending process of the lower jaw, but little displacement occurs, in consequence of the attachment of the pterygoideus internus muscle on the inside of the bone, and of the masseter on the outside, so that the action of the two muscles tends to maintain the coaptation of the fractured portions. When the fracture is through the horizontal plate or base of the jaw, the fractured portion attached to the symphysis is drawn downwards and backwards by the muscles connecting the lower jaw with the os hyoides. If a portion of the bone be detached by a double fracture, the deformity is much greater, from the fractured portions being more completely under the influence of the muscles.

Fractures of the lower jaw are generally very easily recognised; the irregularity of the arch, and of the base of the bone, and the mobility of one part upon another, are infallible signs of fracture of the body of the bone, or of its alveolar edge. As the condyle is only subcutaneous, its fracture and displacement are easily felt; and this is also the case with the coronoid process, which in the mouth is merely covered by the mucous membrane.

Compound fractures of the lower jaw are more difficult to treat than simple, and they unite less readily: but the same means must be adopted in either case as far as relates to the injured bone; in compound fracture, however, the contusion of the soft parts also requires the surgeon's attention: still it must be remarked that fractures of the lower jaw are repaired much more readily than complicated fractures of the bones of the extremities.

With a view of uniting a fractured jaw, the fractured portions of the bone must be brought into close apposition, and maintained in their proper situation by some mechanical contrivance. The first indication is effected by bringing the teeth of the lower jaw in juxta-position with those of the upper; this is readily done by gentle manipulation.

The second is more difficult, and various instruments have been invented to effect the object. Moulds made of pasteboard, plaster of Paris, leather, and other substances, have been employed for the purpose of preventing vertical displacement, while gold or silver wire has been attached to the teeth to obviate the tendency to the horizontal separation of the two portions, the jaw being at the same time supported by bandages.

During the process of union, for the first three weeks the patient should be fed entirely on broths, and if the case offers any considerable difficulties, it may be necessary to inject this liquid food through the nose, or if there be a vacant space from the absence of a tooth, it may be administered through the channel so offered.

The following is a case of compound fracture of the lower jaw, complicated with epilepsy. A patient, aged 35, was admitted into Cornelius Ward with the above injury; he was subject to epileptic fits, and while walking in the street was seized with a fit and fell headlong on the pavement; the lower jaw was fractured between the incisor and canine teeth on the right side; the bone was much comminuted; there was likewise a deep wound an inch and a half in length just under the symphysis of the jaw; this wound was full of dirt. After the lacerated part was cleansed, it was dressed with warm water and lint. One part of the fractured jaw was so much depressed that the top of the incisor tooth was below the level of the gum of the canine tooth. The depressed portion of the jaw was elevated and bound up with a four-tailed bandage, but in the night the patient had a second fit, and during his struggles the jaw was again completely displaced. The fits recurred for the four or five following nights, each time producing displacement of the broken jaw, which had been previously well adjusted. Owing to the difficulty of keeping up coaptation by bandage, it was thought advisable to bind the teeth together with silver wire, after the broken portions of the jaw had been brought into their proper position. Although the fits continued, the wire kept the fractured bone perfectly undisturbed. A week after the wire was applied, a piece of bone about an inch long was removed through the wound in the chin, which then rapidly healed: the bone united, and five weeks from the time of his admission the patient was discharged from the hospital quite cured.

Fracture of the bones of the spine.—The bones of the spine are very similar in character to those of the skull: they are not flat bones, it is true, but, viewed collectively, may be considered in much the same light. They are capable of motion, but this does not in any way affect the spinal marrow, for such is the relative situation and arrangement of the vertebræ, that no motion of the spine can compress the cord, which is perfectly suspended within the column. Although at first, therefore, it may appear inaccurate to speak of the spine as consisting of flat bones, yet in a physiological sense it is perfectly correct.

In consequence of the form and deep position of the bones of the spine, and of the peculiar manner in which they are articulated with each other, they are but little liable to fracture; and when this does occur, it is sometimes very difficult to discover its extent, especially if the spinal marrow has suffered neither compression nor laceration. The best means of ascertaining the amount of injury is, to place the patient prone upon a table or bed, and trace the whole length of the spine along the spinous processes: by this examination the slightest irregularity or unnatural mobility of any part will at once be discovered. If it should be found that the bones of the spine have undergone fracture or displacement, without concomitant injury to the spinal marrow, the patient should be kept in a perfect state of rest, upon a strictly antiphlogistic regimen, employing at the same time such means as appear most likely to prevent any inflammatory action from attacking the spinal marrow and its membranes.

Generally, in fracture of the spine, the displacement of the bones is indicated by the following train of severe symptoms: paralysis, more or less complete, of all the parts below the injured portion of the spine, attended with difficulty of breathing; a tympanitic state of the abdomen, for the viscera, having lost the support of the abdominal muscles, become distended with gas; the penis is almost always in a state of partial erection, the cause of which is not well understood; the fæces are passed involuntarily; but the urine is retained. Another symptom which I have always remarked in these cases, is a peculiar suffusion of countenance; the patient having the appearance of one recovering from asphyxia. These symptoms at once indicate the nature of the accident, and by their severity, the seat of injury may generally be pointed out with tolerable accuracy; the degree of mischief being in proportion to the vicinity of the fracture to the brain. If the fracture be above the fourth cervical vertebra, all the nerves of respiration will be at once paralysed, and instant death result; but if the injury occur just below the point where the phrenic nerve arises from the second, third, and fourth cervical nerves, respiration will go on by the movements of the diaphragm, which is still supplied by the phrenic nerve. In such cases the ribs are motionless, the respiration being carried on entirely by the diaphragm: under these circumstances the seat of injury will be found between the fifth and sixth vertebræ, and the patient cannot be expected to survive more than seven or eight days.

By watching the motion of the intercostal muscles, the surgeon may discover which of the dorsal vertebræ is displaced, and the prognosis would be favourable, so far as refers to the period of dissolution, according as the injury be more or less distant from the brain. In fracture of the lumbar vertebræ, respiration is but little affected, unless a full inspiration be made, when the power of expiration will be found to be diminished, and not equal to that of inhalation; all the other symptoms are, however, present. The involuntary discharge of the fæces is produced by the paralysis of the sphincter muscle of the anus, the peristaltic motion of the intestines being continued; while the contraction of the sphincter is suspended from injury to the lumbo-sacral plexes of nerves, and the motion of the intestines is preserved with the integrity of the sympathetic system. There are, I believe, no cases on record of recovery after these symptoms had set in, and the period during which the patient may continue to live depends upon the distance between the brain and the point where the spinal marrow has been injured. If the displacement of the vertebræ happens in the cervical region, the cause of death is sufficiently obvious from the interference with the function of respiration, and consequent want of decarbonization of the blood; but when the injury happens lower down, and the most urgent symptom is paralysis, the cause of death is not so obvious: and the patient appears to die, rather from irritative fever, produced by sloughing of the nates, unnatural secretions from the mucous membranes of the bowels and bladder, colliquative diarrhœa, and exhaustion, than from any immediate mortal effect arising from the lesion of the spinal marrow.

The treatment in these cases should be regulated by their history; for the symptoms (as in injuries of the brain from fracture of the bones of the skull,) may depend either upon concussion or compression, and the compression may proceed from the depression of bone, or from the effusion of blood, serum, or pus. If, after minute examination, no displacement of bone can be discovered, and the patient had lost all power of motion below the injured part immediately upon the infliction of the injury, it is proper for the surgeon to inquire into the nature of the force which produced the accident, that he may judge whether the effects be produced by mere concussion or by actual lesion of the spinal cord. It might also be ascertained that the symptoms did not come on immediately upon the accident, but subsequently, indicating effusion rather than depression of bone, as the cause of the symptoms.

Where there is evidence of depression of bone it has been recommended to elevate the depressed portion by the use of the trephine or lever. I conceive that there are cases which may warrant the performance of this operation, although at the same time I believe that success can seldom be expected; as the patient must, however, inevitably die if the depression be not removed, it is possible that in some cases the operation might save life if the spinal marrow be without lesion. The operation is not very painful, for sensation, as well as motion, is usually lost below the point of injury, and the surgeon may manage his incision so as to extend it but very slightly into the sensitive parts. When the depressed bone is exposed, it may be raised by the elevator, (assisted perhaps by Hey's saw,) better than by the trephine, which would require more room, and consequently a greater removal of the soft parts. Any attempt to set such fractures, by the application of an extending force, is much more likely to tear the spinal marrow, than to replace the broken vertebræ.

In almost all such cases, general treatment alone can be had recourse to; and means must necessarily be employed to moderate the tendency to inflammation in the affected parts, by the use of leeches or by cupping. A catheter should be passed into the bladder two or three times a day, to prevent the irritation caused by the presence of ammoniacal urine. A highly irritative influence is exercised by the ammonia upon the internal surface of the bladder; by its reaction on the mucus it gives rise to a fœtid, ropy, and acrid mixture, which requires to be frequently drawn off, and diluted by washing out the bladder. Sometimes, under extensive injury to the spinal marrow, particularly when the lesion is high up in the dorsal vertebræ, the kidnies secrete alkaline, and sometimes albuminous urine, which in the diseased bladder undergoes a further change, and seriously aggravates all the symptoms. It is better not to leave the catheter constantly in the bladder, as it produces great irritation in the mucous membrane: the strictest care should also be taken not to wound the coats of the bladder so as to produce bleeding, for the soda in the blood is sufficient to decompose the urine, and cause the evolution of ammonia.

Great attention should be paid to the state of the bowels, which may be relieved at first by purgative clysters, and afterwards, (if there be any tendency to constipation,) by occasional small doses of castor oil. The tympanitic state of the abdomen may be in some measure relieved by rubbing it with the compound camphor liniment. But of all considerations the most essential relates to the position of the patient, in consequence of the great tendency of the skin, from its loss of nervous influence, to slough upon pressure:

this most frequently occurs in the region of the sacrum, and in no case can I conceive the hydrostatic bed to be of so much benefit as in injuries to the spinal marrow. If it appears that the compression depends upon effusion, we must add to the constitutional treatment the use of mercury and antimony, to increase the action of the absorbents: a blister can scarcely in any case be recommended, in consequence of the danger of sloughing. Such are the principles which should regulate the surgeon's management of injuries to the vertebræ.

In fracture of the vertebræ the prognosis is almost always unfavourable; not on account of any peculiarity in the nature of the bone of which the spinal column is made up, nor from any defect in the natural reparative power in these bones, but, as in the case of the bones of the cranium, the danger arises from the nature of the organ enclosed within the bone. This is of such high importance in reference to the vital economy, that the slightest injury to the spine entails the most urgent and uncontrollable symptoms, generally having a fatal termination. If the bone alone were injured in accidents to the spine, the difficulty of reparation would not be greater than that in other bones of the same class, but unfortunately it seldom happens that the bone is injured without producing at the same time compression of the spinal marrow, and when the fracture is of any extent the latter is also generally torn or otherwise injured.

I will now relate a case to show how little we have to hope for in reference to the reparation of the parts.

A patient, aged 30, was admitted into Guy's Hospital, on the 13th of November, with the symptoms of fractured spine. He had fallen from a wharf, twenty feet in height, directly on his occiput. On his admittance into the hospital, about an hour after the accident, he had paraplegia; loss of sensation in the inferior half of the abdomen; and a complete state of priapism. His pulse was very feeble, countenance much suffused, abdomen tympanitic, and breathing difficult. He complained also of a sense of chilliness, and pains in the arms and neck. The urine was drawn off, and was perfectly natural. At night he was ordered 30 drops Tinct. Opii in Camphor mixture. The symptoms remained much the same, with the exception of occasional nausea, until the 16th, when his urine became ammoniacal. The contents of the bowels were also frequently voided involuntarily; sickness continued, but was somewhat checked by administering brandy and soda water, with lemon juice. On the 18th, the urine was much mixed with blood and mucus, still very ammoniacal, and it passed from him involuntarily: the other symptoms remained much as before. He took occasionally an opiate.

He remained in this condition, getting, however, gradually weaker until the 21st, on which day he died.

After death, the whole spinal chord was removed, and found healthy, excepting opposite the sixth cervical vertebra, where its substance was broken down, and very much discoloured; and there was considerable turgescence of the vessels of the dura matral sheath throughout. On a careful examination, the sixth cervical vertebra was found to be split longitudinally, and so separated as to project backwards over the seventh. The posterior ligament of the bodies of the vertebræ was slightly torn.

The diagnostic marks of the nature of this accident were so clear that it was impossible to mistake the cause of the symptoms, as arising from compression of the spinal marrow. As soon as I saw the patient, before I examined the spine, I prognosticated that it was the sixth or seventh cervical vertebra that was injured; and I judged this to be the case, because I observed that all the intercostal muscles below that point were paralysed, respiration being carried on by the diaphragm alone, the action of which was perfect: this could not have been the case if either of the dorsal vertebræ, or the cervical above the sixth, had been fractured.

Fractures of the ribs.—In a physiological point of view, the ribs collectively perform the office of flat bones, in forming cavities for important organs; and they are moreover peculiar, from the extent to which they assist in the function of those organs.

The fifth, sixth, seventh, or eighth ribs, are those most frequently fractured; those above are protected by the scapula and pectoral muscles, while the inferior ones escape fracture by their mobility. These fractures are most common in old age, and generally have their seat at the arch of the rib. They are often irregular and oblique, and sometimes only partial. Fractures of the superior or inferior ribs are most dangerous, on account of the greater force required to produce them, and the consequent injury that may be expected to the included viscera.

Writers on surgery have divided the injuries to the thorax into distinct heads:—1stly, Where the parietes are only contused; 2ndly, Where they are lacerated; 3rdly, Where the serous cavity is opened; 4thly, Where the viscera are wounded; 5thly, Where the viscera are protruding; and 6thly, Where the viscera are lacerated without any wound of the parietes.

In fractures of the ribs, all the above-mentioned conditions (the first excepted) may occur; but there is little liability to the protrusion of the viscera of the thorax, in consequence of its firm bony parietes, which forms one of the great distinctions between wounds of the thoracic and those of the abdominal cavity. When the serous cavity is opened, the chief danger arises from the tendency to pleuritis, which can only be prevented or overcome by extensive depletion. When the viscera are wounded, the danger accrues from three sources: first, from the effusion of air producing emphysema; secondly, from the tendency to the effusion of blood; and, thirdly, from the disturbance to the function of respiration.

When called upon to examine a patient whom we have reason to believe is the subject of fractured ribs, we should endeavour to ascertain whether the viscera contained within the chest have sustained any injury, and our diagnosis would be formed by the use of the stethoscope, and by the urgency of the symptoms. Having ascertained, or at least having reason to believe, that the interior of the thorax is uninjured, the treatment is evident;—a broad bandage should be applied around the chest to produce coaptation of the fractured ribs, and to prevent their elevation. After fracture, the ribs unite very quickly, which, in fact, is the case with all bones that were originally early formed; besides local applications, the patient should be constitutionally treated, by bleeding, purging, with small doses of calomel, opium, and tartarized antimony, to diminish the action of the heart: and low diet and perfect rest must also be observed. These means will usually be found sufficient to secure the patient from subsequent ill effects.

In the second class of injury, in which the fracture is made compound by laceration of the sort parts, if there be no internal injury to the chest, the treatment I have described should be employed; but if the intercostal artery should have been torn through, it may be necessary to secure it, and any other vessel the size of which is sufficient to make the loss of blood a matter of consideration.

When the third class of injury has occurred, from a fractured portion of rib wounding the pleura and opening the serous cavity, it almost invariably happens that the lungs are also torn, and this will be readily believed when we consider the close adaptation of the lungs to the parietes of the chest: these two classes of injury may be properly considered together, and are indicated by air, with more or less blood, rushing from the wound at every expiration.

Should the lung not appear to have been wounded, we should endeavour to unite the wound in the parietes by the adhesive inflammation, employing at the same time an antiphlogistic regimen, to prevent the occurrence of pleuritis. When the lungs are wounded, the treatment depends upon the quantity of blood which flows, and the difficulty of respiration. If the flow of blood be great, and there be any difficulty in its escape, so as to lead to compression of the lung, it is then not only wrong to close the external wound, but it should be enlarged, so as to give free exit to the blood; this may be further assisted by placing the patient in a position to facilitate its flow from the chest. Besides this, a considerable quantity of blood, even to syncope, must be drawn from the arm by a large opening, as the best means to check the bleeding from a wounded lung. Perfect rest, low temperature, acidulated drinks, and every means, on the one hand, of diminishing the action of the heart, and, on the other, of maintaining the secretions, are to be employed; as soon as there is the slightest appearance of reaction, indicated by pain, difficulty of breathing, and, perhaps, by some return of bleeding from the wound, the lancet must again be called in, as the only hope, (dangerous as the repetition of its use may appear,) of saving the patient, by allowing time for the healing of the wounded vessel.

Surgeons have recommended, that, if such an accident have occurred from a gunshot wound, or from any cause by which it is probable that an extraneous substance may have entered the chest, advantage should be taken of the syncope produced by the copious bleeding, to seek for and remove the source of irritation; but I should advise great caution in following this treatment; for there is every reason to dread inflammation of the pleura, after officious interference in wounds of the chest. If, however, extraneous bodies are so near the surface as to admit of their ready removal, they should certainly be withdrawn. Some care will be required, after these active means have been employed, to restore the patient's constitutional powers; for this, however, no general plan can be laid down; it must be left to the judgment, according to the peculiarities of the case.

The fifth class of injury, which relates to the protrusion of the viscera from the chest, is of but rare occurrence, in consequence of the strength of the cavity. Indeed, I cannot understand how this accident is to occur; for when wounded, the contents would not be sufficiently distended to fill the chest, much less to protrude. Should such a protrusion occur, however, the part should be returned by gentle pressure into its natural cavity, and retained there by compress and bandage. Injuries to the chest, when the lungs are wounded, either with or without laceration of the parietes, are attended with an escape of air into the cellular membrane, which is termed emphysema. This symptom, when it happens to a great extent, causes a most frightful appearance, although it is not so alarming as would be imagined from the deformity it produces. The treatment in these cases, when the emphysema is extensive, is to make incisions through the skin, to allow of the escape of the air; and bandages should be applied throughout the whole extent of the distended parts, as well as over the ribs, to diminish motion in respiration. If compresses are employed, they should not be applied opposite to the spot where the wound in the lung has been inflicted, from the danger of forcing a fractured rib still deeper into the lung. Should empyema follow a wound, although it is much more frequently an idiopathic disease, the operation of paracentesis thoracis may be necessary: if so, the puncture to evacuate the pus should be made below the original wound, as adhesions are likely to have formed at that point. What is most to be dreaded, after all, in these violent injuries to the thorax, is the liability to phthisis.

The cartilages of the fourth or fifth central ribs have been known to be fractured, or rather, I should say, ruptured; this is not a common accident, and can only be produced by the application of direct violence. Vidal relates a case in which it was produced by the kick of a horse in the sternal region. Antiphlogistic means only were employed, and the reunion of the parts took place without any difficulty; the only indication here is to prevent internal inflammation.

The following cases show the nature of the practice to be adopted in fracture of the ribs.

John Varty, æt. 56, a coal-porter, admitted into the hospital in consequence of injuries received in a fall while in a state of intoxication. He complained of great pain and difficulty in respiration, which was short and quick. The face was livid, and the pulse quick and feeble, and the extremities cold. Upon examination it was found that three ribs were fractured on the left side. He was put to bed, bottles of warm water were applied to the feet, and warm tea given him to drink; reaction soon came on, and a flannel bandage was then passed around the chest; as he complained of pain in the seat of injury, he was bled to the amount of twenty ounces. He was placed under a general antiphlogistic regimen. He soon began to improve, and continued to go on well until he was discharged from the hospital quite well, about three weeks from the date of the accident.

Patrick Callaghan, æt. 34, a bricklayer, was thrown from a scaffold and so much injured as to be admitted into the hospital. Upon examination it was found that the sixth and seventh ribs were fractured on the left side; his pulse was feeble, the surface of the body cold, and the countenance indicated collapse. He was put to bed, and bottles of warm water applied to the feet. In six or seven hours sufficient reaction occurred to point out the necessity for bleeding, which was continued to faintness; active purgatives were administered, soap plaister and bandage applied around the chest, and low diet enjoined. This treatment was quite successful, and he left the hospital cured, in ten days from the time of his admission.

A boy, æt. 6, was admitted into the hospital with fracture of the third, fourth, and fifth ribs, and also of the clavicle and thigh on the right side. There was emphysema extending over the whole of the chest. When brought into the hospital the boy was in a state of extreme collapse, and little hope was entertained of his recovery. Bottles of warm water were, however, applied to his feet, and in the course of a short time reaction came on. A bandage was applied around the thorax, and the other fractures treated in the usual manner, but it was not found necessary to make incisions to relieve the emphysema, as the dyspnœa had become less urgent. To the astonishment of every one, the patient soon began to show signs of rapid recovery, and within a month of the time of his admission into the hospital he was quite well. During the cure it was necessary to well support the constitutional powers by generous diet and tonics.

Fracture of the bones of the pelvis.—The bones of the pelvis may be classed with those of the skull and ribs; and, pathologically viewed, the injury or fracture of any of this class, leads to much the same considerations: as the attention of the surgeon must be directed to the injury sustained by the organs within the cavity, rather than to the condition of the bones themselves.

The bones of the pelvis, when fractured, would therefore be regarded in somewhat the same pathological sense as the flat bones of the head, excepting that the viscera contained within the cavity of the pelvis are of less vital importance, and consequently it is rarely necessary to resort to any surgical operation to remove depressed portions of bone; at the same time, it is requisite to observe the strictest attention with respect to the antiphlogistic regimen, either to prevent the occurrence, or obviate the effects of inflammation.

From the manner in which the bones of the pelvis are covered with soft parts, and from their immobility upon one another, it is frequently very difficult to detect fractures in them, and the diagnosis must be founded upon the history of the case, and from the train of symptoms which presents itself. Great violence, such as the passage of a heavy weight over the pelvis, or a fall from a considerable height, is generally the cause of injury to these bones; and extensive contusion of the soft parts is usually produced at the same time, so that a knowledge of the circumstances of the accident, and a close examination of the part, will generally lead to sufficient diagnostic marks to enable the surgeon to judge of the extent of the mischief.

Upon the patient endeavouring to move himself ever so little towards either side of his bed, a deep-seated and excruciating pain will be felt, which is so severe as to render him totally incapable of motion: at the same time he experiences a sense of the grating of the bones upon each other. The patient should be placed in a perfectly horizontal position, and carefully examined as to whether the anterior and superior spinous processes of the ilia are on a level, and whether the lower extremities are of the same length; for want of symmetry in either of these instances would indicate displacement of the bones of the pelvis.

Fracture of the ossa innominata.—The bones which compose the os innominatum, are the ilium, the ischium, and the pubes. These are all liable to fracture. The injury generally occurs from the crushing effect of a heavy weight; and it is an accident to which waggoners are liable, as they frequently sleep sitting on the shaft, and sometimes fall beneath the fore-wheel of the waggon.

Fractures of these bones must be treated in the same manner as those of the skull and spine; that is to say, the chief object must be to remedy the mischief done to the organs which the bones enclose. In these cases the diagnosis is sometimes rather difficult. By some surgeons it is recommended to take hold of the os pubis in front, and of the ischium at the back, and to forcibly move these upon each other so as to produce a crepitus; but the degree of force necessary for this purpose is likely to increase the injury already inflicted on the parts. The diagnostic mark I chiefly rely upon is the severe pain experienced by the patient whenever he attempts to move towards the side of the bed. Even if you should be incorrectly led to suppose a fracture when none really exists, you will err on the right side, and no bad effect can result from passing a broad belt tightly round the pelvis. It is usually recommended, that before the surgeon attempts to ascertain which of the bones of the pelvis is injured, he should pass a catheter into the bladder to discover whether the urethra has been wounded, as by the force necessary to ascertain the seat of the fracture, an additional laceration of the urinary apparatus may be inflicted. I do not, however, approve of this practice, as it always increases the irritation; I, therefore, think it better to wait, and first see whether the urine cannot be passed naturally. Even when blood has flowed from the penis, I doubt the use of the catheter being productive of any good, unless there be retention of urine; it is, I think, likely to increase the laceration of the parts; and I have frequently had the gratification of seeing a patient recover, when I had never employed the catheter. Great mischief may also arise from leaving a catheter in the bladder and even its frequent use may produce injurious effects: it is, as I have said, quite time enough to employ it when we find that the patient cannot evacuate the bladder in the natural way.

In fracture of the pubes, a broad belt should be tightly applied round the pelvis to keep the bones in perfect apposition; the patient should be strictly confined to the recumbent posture, and not permitted to use the least muscular exertion. This object may be accomplished by means of a second broad belt passed under the nates, its ends being fastened to a pulley attached to the top of the bed: the patient may be raised by this contrivance without rendering any effort on his part necessary. In combination with these mechanical contrivances, the strictest antiphlogistic regimen is to be adopted, to diminish the tendency to suppuration.

I always consider the force necessary to ascertain the precise situation of fracture of the ossa innominata as likely to produce more injury than could be compensated for by the discovery. I usually subject the patient to the treatment I have already detailed, without exposing him to that which I regard as unnecessary violence, for I look upon the incapacity to move the pelvis as a sufficient indication of the extent of the injury.

The *sacrum* differs from the rest of the bones of the pelvis, by inducing (under accident) paralysis of the lower extremities. This circumstance points out that the sacrum not only forms part of the osseous cavity of the pelvis, but also that it assists in protecting the lower part of the spinal marrow. Injuries to this bone lead, therefore, to a more unfavourable prognosis than fracture of any other part of the pelvis; being, like them, deeply seated, the same amount of violence is necessary to produce a fracture,—an equal degree of contusion occurs to the external soft parts,—the same danger arises of the formation of matter, and the ill consequences of inflammation to the neighbouring viscera; and, in addition to these, there exists the probability of injury to the spinal marrow.

The treatment in such cases is precisely similar to that which has been recommended in fractures of the spine and of the other bones of the pelvis, both with regard to the precautions respecting the urethra and bladder, and also as to the means to be employed to secure the broken bones in just apposition.

The *os coccygis* is strictly a pelvic bone; it is liable to fracture, which, however, occurs but seldom, from the depth of its situation and the motion of which it is capable. The fracture of this bone is accompanied by considerable pain in the coccygeal region; and the nature of the injury may be ascertained by examination per rectum. The pain is much increased by attempting to walk, for some of the fibres of the glutæus maximus take their origin from this bone, and act in displacing the fractured portions. No kind of apparatus can be applied to assist the reunion of the parts of the bone. Rest, poultices, and the antiphlogistic regimen, are to be strictly adhered to, to prevent the occurrence of suppuration. Purgatives should not, however, be administered, as the induced action of the levator ani would disturb the fractured bone.

Ellen Gordon, æt. 28, was attended from the Guy's Lying-in Charity in her third confinement. The labour progressed naturally until the head arrived at the outlet, where it remained for some time. At last, during a violent pain, something was heard distinctly to give way with a noise like the breaking of a stay-lace, and immediately after the child was born. The noise, as was ascertained by an examination per rectum, proceeded from fracture of the coccyx across without any displacement. The treatment consisted in perfect rest and *mild laxatives*. In about six weeks it was united, most probably by ligament, as it remained very moveable.

The following is a case of fracture of the right ilium, which will serve to illustrate the principles which I have laid down. Let me first, however, repeat that, as the bones of the pelvis are not united by moveable joints, they are not individually influenced by the action of muscles; and therefore when they suffer injury, the surgeon is not so much called upon for the application of any mechanical contrivance to keep the fractured portions of bone in apposition, as to prevent by constitutional means the effects of inflammation on the viscera of the pelvis.

A sailor boy, aged 14, was admitted into Guy's Hospital. He had fallen from the rigging of a ship, and alighted on his hip. When brought into the hospital, he appeared to suffer severe pain, particularly when the abdominal muscles were called into action. Upon examination, a fracture was discovered, separating the superior spinous process, and about a fourth of the crista of the ilium, from the rest of the bone. Leeches were applied to the injured part, and antiphlogistic remedies adopted. A long bandage was also placed round the pelvis and the upper part of the right thigh. This mode of treatment succeeded so well that the lad was soon able to get out of bed, and could stand very well, although he walked rather lame; and shortly after, the pain having entirely subsided, and the lameness being much diminished, he was discharged as perfectly cured.

This case well exemplifies how little is to be apprehended from simple fracture of the bones of the pelvis; the chief object always being to prevent, by the application of constitutional remedies, the extension of inflammation to the viscera.

LECTURE XX.

FRACTURE OF LONG BONES.

Difference between flat and long bones in a surgical sense—Liability of long bones to fracture—Necessity for exact adjustment—Difficult to maintain, owing to action of muscles—Causes of fracture—Either predisposing or immediate—Diagnosis of fracture—Prognosis—Treatment—Treatment of compound fracture—Not so easy to produce bony union as in simple fracture—Reparation of bone depends upon the integrity of the surrounding tissues—Reparation of bone very similar to that of soft parts—Process of reparation not the same in all bones—Two methods adopted by nature—Illustrated by the reparation of the bones of the cranium and of the long bones—Round bones repaired by a union of both methods—Process of reparation of long bones—Facility of union dependent on the proportion of animal matter they contain.

A VERY considerable difference exists between the flat and long bones in the circumstance of the latter being surrounded by soft parts, which are intended to assist in their reparation after fracture: the permanent union of the fractured extremities is not, however, produced by these means, but merely the temporary holding together; this is effected by the temporary cartilage, the elements of which are thrown out by the neighbouring tissues, and afterwards converted into what is termed the provisional callus. In the flat bones, the process of union depends entirely upon the vessels of the bone itself, and the operation is carried on very slowly; in the long bones, the reparative action is more rapid, but even in that case it requires, after fracture, eighteen or twenty months to restore a bone to its original condition.

From their form the long bones are more frequently broken than any others, and it is in the treatment of fracture of the bones of this class that the art of surgery is particularly called in requisition.

The difficulties connected with the treatment of fracture of the long bones are referable to the action of the muscles attached to them, as the just coaptation of the fractured extremities is opposed by their being drawn in the direction in which the various muscles act. Myology is, therefore, an essential study in comprehending the treatment of solution of continuity in bone; as it is only by this knowledge that the deformities inseparable from fracture can be appreciated and overcome.

Causes of fracture.—When solution of continuity in a bone is manifest from the existence of unmistakable diagnostic marks, it may appear unnecessary and unimportant to trouble ourselves about the cause of the injury; but as diagnosis, prognosis, and treatment may often be regulated by a knowledge of the circumstances attendant upon the accident, these can never be regarded as unworthy attention. The cause of a fracture may be either *predisposing* or *immediate*. Predisposition to fracture may arise from position, or from the situation which the bone occupies in the body; the clavicle, for example, which is but slightly protected by soft parts, and is so intimately connected with the motions of the upper extremity as to be constantly exposed to the operation of external forces, is especially liable to injury; secondly, from function, as in the case of the radius, which, from being articulated with the bones of the hand, is much more likely to be injured from the application of force to the latter than the other bone of the forearm which is not similarly united; thirdly, from constitutional peculiarity, as where a preponderance of earthy matter produces in the osseous system a degree of brittleness and fragility, or malignant disease so changes the healthy condition of the bones as to render them incompetent to sustain the force exercised by the natural action of the muscles; or where, indeed, any constitutional deterioration interferes with the assimilative powers so as to check the elimination of the bony constituents, and predisposes to the yielding of the bone already formed. The immediate cause of fracture may be a blow, a crushing force, inordinate muscular contraction, or what is termed "contre-coup."

With respect to blows, or any other external force, the effects are too obvious to require a lengthened explanation, and we have but few examples of fractures which result from muscular contraction: the olecranon of the ulna, the patella, and os calcis, are certainly subject to lesion from this cause; and fracture of the patella especially results as frequently from the force of the extensor muscles as from the application of a blow to the bone itself: the expression "contre-coup" is employed in a surgical sense to designate a mechanical reaction which is sometimes the cause of fracture, particularly of the long bones. A person jumping from a height, unless he flexes the joints of the lower extremities at the moment of alighting, experiences a jarring shock; this arises from the circumstance that the momentum which the trunk has received during the descent is continued, even after the feet have met the ground: and the lower extremities being fixed, whilst the tendency to descend is still maintained in the body, the femur is driven into the acetabulum, and the force of the blow is returned, or, as it were, reflected in the substance of the bone itself; fracture being the result whenever the force of the rebound exceeds the cohesion of the osseous matter. The centre and neck of the thigh-bone are particularly liable to fracture from contre-coup.

When fracture occurs to one of the long bones, the diagnostic marks are in most cases sufficiently obvious to lead at once to a correct knowledge of the nature of the injury; the symptoms are, deformity and shortening of the limb, crepitation on moving the fractured extremities of the bone, and loss of natural motion, with the substitution of a mobility existing independently of the articulations. To appreciate the first of these signs, the surgeon must be fully acquainted with the normal conformation of the limb in reference to the anatomical relation of its parts. The second, or shortening, is not ascertained without some difficulty; it can be best effected by placing the patient on a very hard bed, and carefully examining the relative length of the limbs, after having arranged the trunk in a perfectly symmetrical position. Crepitation must be regarded as the least fallacious of all the diagnostic signs of fracture, but it is not always easy of detection, in consequence of the depth at which the fractured bone may be situate, or from its constituting one of two bones entering into the composition of the same portion of a limb; as for example, in case of fracture of one of the bones of the fore-arm or leg. Whenever difficulty arises in endeavouring to discover a crepitus, while the other indications of fracture present themselves, I do not consider it advisable to persist in seeking the former, for as much injury may be inflicted by the manipulation as by the original lesion. It is possible, also, to mistake for crepitus the sensation produced in moving a joint in which the synovia has become inspissated,—a condition frequently existing in a rheumatic diathesis.

By fracture the voluntary motion of a limb is destroyed, but, as I have said before, an abnormal mobility entirely independent of any natural joint, may be given to it. This unnatural condition is sometimes, however, difficult to detect, from precisely the same causes as those which occasionally interfere with the discovery of crepitation.

The prognosis in fracture is formed upon the consideration of the constitutional power of the patient in reference to his capability of sustaining and repairing the injury. In weak and irritable constitutions, or in individuals whose vital power has been injured by old age, the nature of their employment, or by dissipation, it would probably be advisable to amputate the limb rather than to expose the patient to the effect of the protracted constitutional efforts necessarily attendant upon the reparation of such an injury: the necessity for this step would also, however, depend upon the extent of the lesion, and the condition of the soft parts. Cæteris paribus, it may be considered that fracture of a superficial bone is less important than that of one more deeply seated,—of the middle of a bone less so than that of the extremities,—a transverse less dangerous than an oblique fracture,—and fracture of the bones of the upper extremity not so serious in its effects as that of the bones of the lower: besides the mere lesion of the bone, however, the laceration of the muscles and the rupture of bloodvessels and nerves may occur to such an extent as to prove even more dangerous than the fracture itself. With respect to amputation, I cannot too forcibly insist upon the necessity for forming an *immediate* judgment; for if the surgeon neglects at the favourable moment to make his decision, guided, of course, by a just appreciation of the reparative power of the patient in reference to the extent of the injury, the opportunity will probably never present itself after reaction and irritative fever are established, and the life of the individual may consequently fall a sacrifice to want of promptitude or judgment: due caution is nevertheless necessary, to prevent the sacrifice of a limb where there is just and reasonable ground to expect that the reparative efforts may be brought to a successful termination. When summoned to a case of fracture, the first and chief object of the surgeon should always be to save life; the second, to preserve the injured limb; and the third to render, by the judicious application of remedies, that limb again capable of performing its natural functions.

In fracture of the long bones, the principal indication is to restore the limb as nearly as possible to its natural form; and, generally speaking, it may be said that this is effected by the application of force in opposite directions, technically termed extension and counter-extension; during the operation of this force, the surgeon produces exact coaptation of the broken portions of the bone, and they are preserved in the requisite position by the aid of a mechanical apparatus. This method of treatment is not, however, always necessary, as in fracture of the lower extremity of the femur, where there is no displacement, owing to the great extent of the surface of the fractured parts, the upper and lower portions of bone being from this cause held in their natural relative situations; the same may be said when only one bone is fractured of two, which together constitute one portion of a limb; in this case the entire bone serves as a kind of splint to that which is broken, and effectively prevents longitudinal displacement and deformity of the part. Under these circumstances, it is only requisite to employ those constitutional and local remedies which will tend to diminish and control the inflammation likely to ensue from the lesion. When it is necessary to apply force to produce coaptation of a displaced fracture, the extending power must be applied to the portion of the limb below the point of lesion, the counter-extension being applied above the fracture, or to the trunk: these forces should be brought into operation very gradually, with the intention rather of overcoming muscular action by producing fatigue, and consequent relaxation, than by the application of a force greater than that of the contractile power of the muscles. During the operation of these extending forces, coaptation of the fractured parts must be produced: this is usually effected with sufficient ease, but it is often very difficult afterwards to keep them together. In order to preserve coaptation, it is evident that some apparatus must be employed to overcome the tendency of the muscles to displace the adjusted fracture: with this object we make use of splints of different kinds. It will not be necessary for me to describe all the varieties of this apparatus, for a knowledge of the principles of the treatment of fracture will direct your judgment in the choice of the apparatus best suited to any particular case. It must, however, be borne in mind, that considerable power and uniformity of action are indispensably requisite in an apparatus employed to maintain continued extension in case of fracture. At the same time, you must remember that there is a great difference in the application of force to organic and inorganic matter; and that the muscular irritability, which may be much increased by the injudicious application of excessive force, might be completely subdued by the employment of gentler means of resistance. In case of fracture of the lower extremities, I consider Dessault's splint the most generally available, as it not only mainains permanent extension and counter-extension, but also affords o the surgeon the advantage of being able to examine at any noment the condition of the limb, enabling him to judge of its rogress towards reparation. The application of bandages to a ractured limb before splints are adjusted will be found of the ighest utility, as they afford a general support to the muscles, hich tends greatly to diminish their irritability: bandages are, owever, inapplicable in fracture of the fore-arm or leg, as they would serve to disturb rather than promote coaptation, by pressing the fractured extremities out of their natural position.

The proper time for applying apparatus or bandages depends upon the conditions concomitant with the fracture; for if there be great contusion, swelling, and inflammation, these must be first subdued by local and constitutional means. Nevertheless, it is my constant rule to apply splints as soon as the state of the parts will allow, for if their application be delayed, the muscles acquire a chronic contraction, which it is afterwards extremely difficult to overcome. The constitutional treatment in simple fracture consists in allaying the irritation and local inflammation; purgatives should not, however, be made use of as the antiphlogistic agents, as they occasion great disturbance to the patient in the actions incidental to their operation. Tartarized antimony is perhaps the best remedy that can be employed, but its depressing influence should not be too long continued, as a certain amount of increase in the arterial circulation is requisite to the due progression of the reparative process.

Adjustment of the bone is as necessary in compound as in simple fracture; but the difficulties are often greatly increased in the former case, from the bone protruding through the soft parts so as to render it necessary to enlarge the wound, or to saw off the projecting portions of bone, before the reduction can be effected. Afterwards, however, the wound should be healed as rapidly as possible, in order to convert the compound into a simple fracture; and this object is most readily attained by laying on the part a piece of lint saturated with the blood; pillows and tapes being the only apparatus employed at first to maintain the position of the parts; subsequently, however, splints, modified in form according to the extent and situation of the lesion, must be adopted. More difficulty is experienced in producing bony union in compound than in simple fracture, owing to the degree of injury inflicted on the soft parts, which are essential to the formation of provisional bone: nevertheless, if no unfavourable circumstances supervene, the treatment is almost similar in both cases; the patient requiring, however, more constitutional support in that of compound fracture, from the extensive nature of the injury, and consequent greater demand upon the vital powers.

Attention to these rules will, I think, indicate in almost every case the principles which should regulate the treatment of fracture: but in the actual application of these principles, there are doubtless numerous practical difficulties. In the wards of a hospital these difficulties are diminished by the surgeon having within his reach all the requisite appliances,—as apparatus of the best possible construction, convenient beds, experienced assistants, &c.; while in private practice much more depends upon his own skill and energy, and he must rely almost entirely upon his own resources to turn to the best advantage the inefficient means with which he is likely to be furnished.

As the reunion of a fractured bone depends entirely upon the integrity of the surrounding tissues, it is necessary, before we treat of the reparation of bone, that we should devote some brief consideration to the manner in which the soft parts are restored to their normal condition.

Wherever laceration of the soft parts is concomitant with fracture, we find the first efforts of nature directed to their restoration, and it often occurs, in cases of compound fracture, that the vital power is so much exhausted during the reparation of the soft parts, as to produce a constitutional condition unfavourable to the formation of new bone. The process by means of which the soft parts are healed resembles very much that employed by nature in the restoration of the integrity of a bone, excepting that in the former case there is no deposit of phosphate of lime or bone earth.

The first of the phenomena which ensue after lesion is effusion of blood to a greater or less extent, according to the amount of injury inflicted: the absorption of the serum and red particles occurs next, leaving the fibrin, which, acting as a foreign body, becomes the source of the necessary stimulus to the emission of the liquor sanguinis: the latter is speedily converted into an indurated crust or "scab," which seems intended to act as a protection to the subcuticular structures, defending them from the influence of external agents, to the end that the definitive reparation may not be interrupted or impeded; fulfilling, indeed, somewhat of the duties of provisional callus, which facilitates and promotes the ultimate restoration of the bone to a healthy condition: beneath the "scab" the albumen of the fluids is coagulated, becomes organized, the wound healed, and the integrity of the soft parts re-established.

The process of the restoration of osseous matter is not alike in every description of bone; nature appears, indeed, to adopt two distinct kinds of action, one of which manifests itself in the tissues surrounding the injured bone, while the other originates in the osseous structure itself: the first of these is the mode of union in the shafts of the long bones, commencing immediately after the occurrence of the accident; the second is that employed in the reparation of the bones of the cranium; it does not commence for a considerable period after the injury has been inflicted, and requires a long time to re-establish the normal condition of the parts; the fact, however, that ultimate restoration of the cranial bones does take place, is proved by the examination of crania which have been subjected to fracture at a time long anterior to death: in such cases the edges of the fracture will be found rounded off, the spicular character being completely destroyed by a gradual interstitial growth, by which the fissure is slowly filled up. This process appears similar to that operating in the definitive union of the long bones; but it proceeds with extreme slowness, from the want of contiguity of the disrupted portions. The articular extremities of the long bones, the flat bones of the pelvis, and the round bones, seem to unite by a combination of the two actions already described: that is to say, both by means of interstitial growth and the reparative power of the surrounding tissues.

Shortly after fracture has occurred, effusion is produced by an extravasation of blood which gets between the bone and the periosteum, and completely closes the ends of the medullary canal, as if to prevent the escape of marrow; it also becomes infiltrated into the surrounding cellular tissue. If it be a simple fracture, in the course of six or eight hours the swelling loses its fluctuating character, owing to the blood having coagulated: this is the first step towards reparation, and the coagulum may be regarded as a kind of splint provided by nature for the support of the disrupted parts. In about ten hours after the occurrence of the accident, absorption commences, and the serum and some of the red particles of the blood are removed: this superficial absorption of the red particles produces the "black and blue" appearance of the skin in cases of contusion. After the partial absorption of the effusion, the swelling begins to subside, and the skin, which was tense, gradually reassumes its natural condition; the fibrin of the effused blood is still, however, left, and, acting as extraneous matter, it produces considerable irritation in the neighbouring parts: this effect is indicated by pain, heat, and redness—the usual marks of inflammation. If these symptoms should be very violent, measures must be taken to check them; but we must be cautious in interfering with this inflammatory action which is established by nature as a means of promoting the union of the fracture. It is possible that the extremities of the bone may be the source of much irritation, for it frequently happens that although the fractured portions were carefully restored to their natural position when the fracture was discovered, the spasmodic action of the muscles may have afterwards displaced them: under such circumstances the coaptation must be restored, and opium administered to allay the muscular irritability.

After the absorption of the effused blood, and the subsidence of the swelling, a second effusion occurs: this is, however, of a different character from the first; it is less profuse, and consists of a plastic coagulable lymph, which becomes firmer by degrees as more albumen is effused, until at length it forms cartilage: thus, at the expiration of about ten days, the fracture is surrounded by a very effective splint formed within the periosteum and extending to the neighbouring cellular tissue: minute bloodvessels soon become distinguishable, but so long as the new deposit retains its cartilaginous character it is said that they do not convey the red particles: after a short time these vessels enlarge, and anastomose with those of the original bone; and at this period bone-corpuscles may easily be discovered by the microscope. The conversion of the temporary cartilage into provisional bone usually takes place about five or six weeks after fracture of the femur, and three or four after that of the humerus.

The provisional bone is generally very large at first, but goes on contracting, at the same time pressing the ends of the broken bone more closely together. If at this period a section of a fracture undergoing the process of reparation be examined, the provisional bone can be seen completely surrounding the point of lesion, but the fracture itself still remains ununited. Ultimately, lymph is thrown out between the approximated extremities of the broken bone, cartilage is formed, which after a while is furnished with bloodvessels, and the definitive osseous deposit is then completed. Lastly, the provisional bone is absorbed, and the medullary canal, which was blocked up by the new bony matter, is re-formed.

In a general view of the long bones, we shall find that the same characteristic circumstances are attendant upon their individual injury, and that the method adopted by nature for their reparation is in all cases similar in principle, the only difference being that arising from the varying specific amount of osseous matter, and the size of the particular bone: the former consideration is one of great importance in relation to the union of fracture, for, as a rule, the reparation of an injured bone is slow in proportion to the quantity of bone-earth it contains.

The scapula may, perhaps, at first sight appear to partake somewhat of the character of a flat bone, but its fracture, like those of the long bones, unites through the medium of a provisional callus: it has powerful muscles attached to it, and its functions differ from those of the flat bones with respect to its not directly protecting any important organ. I shall therefore commence my lecture on the fractures of the bones of the upper extremity, by describing those of the scapula.

LECTURE XXI.

CONTINUATION OF FRACTURES OF LONG BONES.

Fractures of the bones of the upper extremity.—Fractures of the scapula—How generally produced—Diagnosis—Symptomatic signs vary according to the part of the bone broken—Treatment—Fractures of the clavicle—Symptoms—Prognosis—Treatment—Fracture of the humerus—Displacement of the fractured extremities by the attached muscles—Depends upon the situation of the fracture—Diagnosis—Treatment—Precautions necessary to prevent disturbance of the fracture—Fractures of the fore-arm—Of the radius—Most usual seat of fracture—Symptoms—Fracture of the ulna—Of the olecranon—Indications—Diagnosis—Local treatment—Fracture of the bones of the hand——How produced—Diagnosis—Indications.

FRACTURES OF THE BONES OF THE UPPER EXTREMITY.

The bones of the upper extremity consist of the scapula, the clavicle, the humerus, the radius and ulna, and the bones of the hand—viz., the carpus, metacarpus, and phalanges of the fingers. In speaking of the fractures to which these bones are liable, I shall commence with the scapula.

Fracture of the Scapula.—This bone is not often the subject of fracture, on account of its great mobility, and from its being protected by thick strong muscles; this is not, however, equally the case in all parts of the bone, some of which are therefore more than others likely to be broken, upon the application of any violent external force. Fractures of the body of the bone are always produced by some direct force, and are accompanied by contusion of the soft parts, and sometimes by laceration and splintering of the bone. In these fractures there is but slight displacement, as the broad muscles which cover the bone are attached to both the broken portions, and do not permit of much change of position in them. In fractures of the *acromion,* the nature of the accident may easily be discovered, as the fractured portions are very much displaced by the action of the muscles; the roundness of the shoulder is lost by the weight of the extremity, and the action of the deltoid muscle drawing the point of the acromion downwards; while the trapezius and levator scapulæ have a tendency to draw the scapula and the remaining portion of the acromion upwards and slightly backwards. When the *inferior angle* of the scapula is separated from the rest of the bone, the deformity which occurs is sufficient to mark the nature of the accident. The detached portion is drawn forwards by the inferior fibres of the serratus magnus, and by the teres major; while the rest of the bone remains in its natural position. The most conclusive diagnostic mark of this fracture is, however, the circumstance that, if the scapula be moved, the detached angle remains perfectly stationary. If the *coracoid process* of the scapula be broken off, its extremity is drawn downwards by the coraco-brachialis and biceps muscles, and forwards by the pectoralis minor. If the fracture extends completely across the bone, the displacement is produced by the action of the serratus magnus, which, being strongest at its lower part, draws the inferior portion of the scapula forwards, so that by passing the finger along the posterior edge, an irregularity may be felt.

In all cases of fracture of the scapula, great attention must be paid to the constitutional treatment, as the principal danger arises from the contusion and injury to the soft parts, which almost necessarily attend this fracture. Bleeding, purging, and a general antiphlogistic regimen, are to be strictly adhered to, to prevent inflammation of the part from terminating in abscess; for if it go on to so great an extent, it is more than probable that exfoliation of bone will take place. When the dorsum of the bone is fractured, the arm ought to be fixed to the side, by means of a long roller passed round the chest, enclosing the arm from the shoulder to the elbow, the bandage being applied somewhat in the same manner as in fracture of the ribs; but when the fracture is at the inferior angle, the arm must be drawn across the fore part of the chest, and confined there, so as to bring the scapula towards the detached angle, which is itself too small to be drawn up to meet the other part of the scapula. In the treatment of fractures of the acromion, the head of the humerus must be forced upwards, and retained in that situation, so that it may form a kind of splint or support to the acromion: to effect this, a bandage must be passed round the arm and trunk, and carried by several turns from the elbow to the shoulder, so that it forms a kind of short sling. This bandage must be worn for some time, at least six weeks, as the acromion is slow to reunite. In fracture of the coracoid process, the fibres of the coraco-brachialis, pectoralis minor, and biceps muscles, must be relaxed, to overcome the displacement of which they are the cause. This is to be done by bringing the humerus forwards, pressing the scapula inwards, and bending the fore-arm to a right angle,—keeping the whole fixed in this position by judiciously applied bandages. In fracture of the coracoid process, such treatment would be necessarily indicated by the knowledge of the action of the muscles attached to it; but it is a very rare accident, and one which I think could scarcely result, excepting from a gunshot wound, so that the plan of treatment laid down must be looked upon as rather hypothetical than practical.

Fracture of the Clavicle.—The peculiar situation of the clavicle, between the sternum and scapula, its proximity to the surface, and above all, its form and slender size, are so many reasons why fractures of this bone should not be uncommon. It may be the result of the operation of a direct force, or from contre-coup. A fall upon the point of the shoulder is not an unfrequent cause of fracture of the clavicle, as the latter is driven with great force against the sternum, and broken about its centre.

The diagnosis of fracture of the clavicle is generally easy: after a fall on the point of the shoulder or a blow on the bone itself, the arm is rendered immovable and pendant, and rotated somewhat inwards. The arm cannot be raised nor brought in front, nor can the hand be lifted to the head; the shoulder on the injured side is lower than the other, and nearer to the median line. The external or scapular portion of the broken bone is that which is displaced, being drawn down by the weight of the extremity to which it is attached, and leaving the inner or sternal portion in its natural position. Although, in fact, it is the external portion of the bone which is displaced, still, from the position of the part remaining attached to the sternum, it forms a projection beneath the tightened skin, which not only produces great deformity, but gives the impression that this is the portion which has undergone displacement. This is, however, at once seen to be an error, when the shoulder is raised into its natural situation, as the deformity is then entirely removed. In examining, to discover the fracture, the surgeon should pass his finger along the whole extent of the clavicle, to ascertain the precise situation and direction of the injury; and then by raising and supporting the elbow, at the same time placing a pad in the axilla, and bringing the elbow to the side, to give the shoulder an outward direction, he brings the external broken portion of the bone up to that which remained fixed, and thus produces a crepitus. If the fracture occurs externally to the tubercle, which marks the limit of the insertion of the coraco-clavicular ligaments, there is scarcely any perceptible deformity; but an attentive examination of the parts will enable us to detect the unnatural mobility, and to distinguish the crepitus.

In the treatment of fracture of the clavicle, a large firm pad must be placed in the axilla, the elbow must be raised so as to bring the outer portion of the bone in apposition with the inner, and a short sling must be applied to keep the arm in the proper position: in the next place a long bandage must be wound round the chest, including the whole length of the upper arm of the injured limb in its folds; this will keep the elbow close to the side, whilst the pad in the axilla will force the shoulder outwards, and prevent its tendency to fall in upon the thorax. In comminuted fractures of the clavicle, and in cases where the fracture extends with great obliquity, the skin may be lacerated by the broken portions, the fracture being thus rendered compound; this circumstance would of course render the prognosis much less favourable than when the fracture is simple, as in the latter case the bone generally unites in about three weeks.

Fractures of the Humerus.—The humerus may be fractured in any part of its length, but is more liable to this accident in its middle portion; it is generally by the application of a direct force that fracture of the humerus is produced; but, at the same time, instances are recorded in which it has not only been broken without the application of great external violence, but even by a sudden exertion, such as the lifting a weight or throwing a stone. The degree of deformity which occurs in this fracture depends upon its situation and direction: it is greatest, and takes place most readily, when the fracture is oblique. The symptoms of fracture of the body of the humerus are, a fixed pain at the seat of the injury, a want of voluntary power of motion, difformity of the limb, mobility of the lower portion of the bone, and crepitation: all these make the diagnosis of this fracture easy; and generally, when it is simple, the prognosis is favourable. The humerus may be fractured through its neck (within the capsular ligament); just below the tubercles; in the space between the insertion of the pectoralis major, latissimus dorsi, teres major, and the deltoid; in the centre or body of the bone below the deltoid; or just above the condyles. *Fracture through the neck,* within the capsular ligament, is an accident of rare occurrence. When it happens there is very little displacement of the fractured extremities of the bone, as they are retained in almost their natural situation by the capsular ligament; the shaft of the bone is nevertheless drawn slightly upwards and outwards; but the rotundity of the shoulder is not destroyed. Crepitus may easily be felt in consequence of the fractured extremities being so nearly in contact; for, owing to the capsular ligament not being torn, the parts of the bone can be but slightly separated. There is also considerable pain, which is greatly increased by any attempt on the part of the patient to move his arm. The treatment necessary in this accident is, to confine the arm in a short sling, to place a pad in the axilla, and to apply pressure on the greater tubercle by means of a compress and bandage, adjusted so as to press the upper extremity of the shaft against the head of the bone, which remains in its natural position in the glenoid cavity. Fracture of the humerus immediately *below the tubercles* is a much more frequent accident than that just described; in this fracture there is considerable deformity of the shoulder, for the superior portion of the broken bone being under the influence of the spinati muscles, is drawn upwards, outwards, and backwards, while the inferior part is drawn inwards by the pectoralis major and latissimus dorsi. No tumour can be felt in the axilla, and the whole limb is moveable, so that a very slight force is sufficient to restore it to its natural position; the moment this is discontinued, however, the deformity returns; there is also in this case loss of voluntary power to move the arm. The treatment of fracture of the humerus below the tubercles is much the same as that in fracture of the clavicle: a large conical pad should be placed in the axilla, with its base upwards, the arm being confined to the side by a bandage which must include the whole space from the shoulder to the elbow; four splints ought also to be applied to the arm, to prevent displacement by the muscles. When the fracture occurs *between the insertion of the pectoralis major, latissimus dorsi, and teres major, and that of the deltoid muscle,* the position of the broken extremities of the bone is very different to that in the fracture last described: in this case the lower part of the bone is drawn upwards and outwards by the action of the deltoid, so as to form a very perceptible tumour in the outer side of the arm; and when the fracture is oblique the deformity is increased by the action of the pectoralis major and latissimus dorsi, which draw the upper portion of the bone inwards. Extension and counter-extension must be made, so that the fractured surfaces may be brought into apposition, and splints and bandages applied, to keep them from being displaced after their adaptation has been effected. To prevent the muscular action from drawing the portions of bone out of the position in which they have been placed, the latissimus dorsi and pectoralis major should be relaxed by confining the arm close to the trunk. If the bone be broken *below the deltoid,* there is but little difformity, owing to the antagonistic action of the brachialis anticus in front and the triceps behind, which muscles acting as a kind of splint keep the portions of bone from being much displaced: if the fracture be oblique the displacement is greater than when it is broken directly across; but in both cases the lower portion is drawn a little forwards. If this fracture happens very near to the elbow-joint, it is often mistaken for dislocation of the radius and ulna, in consequence of the difformity being nearly the same in both cases, but the distinction between them becomes at once apparent by making extension of the arm; when, in fracture, the difformity will disappear immediately. In the treatment, the fore-arm must be bent at a right angle, and kept in that position by pasteboard splints and bandages, and in consequence of the proximity of the elbow-joint, it should at the same time be kept constantly wet with an evaporating lotion.

Vertical fracture of the humerus through the condyles sometimes happens. This fracture most frequently occurs to the internal condyle, in consequence of its projection and the slight protection it receives from the soft parts; it also most frequently happens at an early age. The deformity in this fracture gives the idea that the ulna is the bone displaced, as the olecranon projects posteriorly, but the nature of the injury can easily be ascertained by extending the arm, which will restore the ulna to its natural position. The treatment consists in applying a bandage round the joint, with the fore-arm flexed, and in putting on splints of wetted pasteboard, or gutta percha, to keep the broken pieces of bone in the proper position. About three weeks after the accident, passive motion should be begun, to prevent anchylosis. When the external condyle is fractured, swelling, immobility of the elbow-joint, and crepitus, are the diagnostic marks. The crepitus is most perceptible when the patient attempts to rotate the hand. When a large portion of the condyle is broken off, the detached portion is drawn upwards and backwards: the treatment is the same as that in fracture of the internal condyle.

Fractures of the Fore-arm.—This accident is of rather frequent occurrence; it generally happens in the middle or inferior part of the arm, seldom in its upper third, where the bones are completely protected by thick muscles; both bones are sometimes broken at the same height, at other times one is broken much below the other. The fractures of the fore-arm may be transverse or oblique, simple or compound. The radius is much oftener broken than the ulna, as, in a fall, the radius, owing to its articulation with the hand, receives the whole impulse: pain, loss of power to rotate the hand, and crepitus on motion, form the diagnostic marks of the accident. The broken portions of bone form an angle inwards towards the interosseous space, rendering the latter narrower, and forcing out the muscles it contained.

Fractures of the Radius.—The radius is most frequently broken at its inferior part, as it requires great force to fracture it in its upper third, owing to its being surrounded by thick muscles. This injury is therefore very rare, and must be serious in its character, from the great contusion with which it must be complicated, and which would probably implicate the elbow-joint. If the fracture happens through the neck of the radius, the diagnosis is very obscure, not only from the depth of the seat of injury, but likewise from the difficulty of producing crepitus; it is also, I believe, an accident of such rare occurrence, that the instructions laid down for its treatment can scarcely be regarded as having much practical value.

Fracture of the middle of the radius is not unfrequent, and is, I believe, always the consequence of a direct application of force. It was formerly thought that this fracture was often the result of contre-coup, but numerous observations have shown that this was an erroneous opinion, and that fracture of the middle of the radius by contre-coup is very rare. The diagnosis of this fracture is easy: fixed pain, deformity of the fore-arm, which is narrower than is natural, want of power to pronate or supinate the hand, with the crepitus which the attempt at motion produces, are sufficient to point out the character of the injury. Fractures of the lower part of the radius are often misunderstood, and may be taken for incomplete dislocation of the wrist; but the power of restoring its normal conformation by slight force, together with the crepitus, is sufficient to distinguish this accident from dislocation. The fracture of this portion of the radius is very frequent, and is said to form almost a third of all the fractures of the bone. This circumstance is explained in great measure by the structure of the bone, which in this part is soft and spongy, being only coated with a thin layer of compact osseous matter.

The following is a case of fracture of the lower portion of the radius:—

Janet Westbrook, æt. 68, was pushed down in the street, falling forwards. On thrusting out her hand to save herself in the fall, it came violently in contact with the curb-stone, the consequence being fracture of the radius about two inches above the styloid process. She was immediately brought into Guy's Hospital. The swelling being but inconsiderable, the nature of the accident was ascertained at once. The usual symptoms of fracture of the radius were all present, viz., fixed pronation of the hand, diminished width of the fore-arm, from the approximation of the fractured extremities to the ulna, and the rotundity produced by the displacement of the muscles and tendons of the interosseal space. The limb was put up in the ordinary way, the hand being left pendant. In the course of five weeks the woman left the hospital quite recovered, and with perfect motion of the radio-ulnar articulations.

Fractures of the Ulna.—The fractures of this bone are less frequent than those of the radius, owing to the circumstances which I have already described. When broken, it is usually in its lower third, where it is smallest, least protected by muscles, and, in this case, only the lower portion of the bone is displaced. The injury is easily detected by passing the finger along the inner edge of the bone; an irregularity will be felt at the point of fracture, in consequence of the lower fragment of bone being drawn outwards towards the radius by the action of the pronator quadratus muscle.

Fracture of the Olecranon sometimes occurs; it is then separated from the ulna. This accident is said to occur occasionally from inordinate action of the triceps muscle, but a fall upon the elbow is a much more frequent cause. When the olecranon is fractured, it is drawn upwards above the condyles of the humerus by the action of the triceps, so that a hollow is formed at the posterior part of the elbow-joint, instead of the projection which exists here in the natural state of the parts. The amount of separation between the olecranon and the ulna being increased and diminished by flexion and extension of the elbow, is another diagnostic mark, and assists in making the nature of the case quite obvious. If the fracture be caused by great violence, the contusion and swelling of the soft parts may interfere with the diagnosis. Under such circumstances the treatment must be directed against the inflammation, disregarding the fracture until the inflammatory symptoms are sufficiently subdued to permit of the extent of injury being ascertained. The treatment in fracture of the olecranon differs from that of any other accident to the fore-arm. It consists in perfectly extending the arm and bringing the detached olecranon in contact with the ulna by stretching gently and gradually the triceps muscle. The bone must be maintained in its position by a stellate bandage passing above and below the elbow, and continued along the whole length of the humerus. The anterior hollow of the elbow should be filled with lint, and a long splint applied over it, to maintain the continued extension of the limb which is necessary to the reparation of the bone.

The following is an example of fracture of the olecranon:—A gentleman, æt 27, was thrown from his horse with some violence, his left elbow coming in contact with the ground; in about an hour after the accident the elbow-joint was very much swelled and inflamed, especially just opposite to the centre of the olecranon, where there was a rounded circumscribed soft tumour, into which the finger very readily sank; but I could discover no separation of the olecranon. Upon desiring the patient to use the elbow-joint, he could both extend and flex the forearm with so much facility and to so great an extent, that I doubted whether any fracture existed, and it was not until three days after, when the tumefaction had subsided, from the application of leeches and evaporating lotion, that I could arrive with certainty at a knowledge of the nature of the accident. He was treated in the manner I have described, and perfectly recovered the use of his arm in about five weeks from the time of the accident.

When *both bones of the fore-arm* are broken, it generally happens from a heavy weight passing over the arm, or from a violent blow; a fall can scarcely produce fracture of both bones at once, as in such an accident the radius receives the whole weight of the body. The diagnosis may be formed from the following indications:—pain, loss of motion, particularly as to rotation of the hand, and crepitus; and the arm has a rounded appearance, as if tumefied, in consequence of the projection of the muscles from the interosseous space. In the treatment of this fracture, the hand must be placed between supination and pronation, and directed slightly towards the ulna; the fore-arm must be semiflexed, and then by making gentle extension and counter-extension the protruding muscles may be pushed back between the bones, in which situation they may be kept by placing, both before and behind the arm, a pad, which must extend from the elbow to the wrist;—the pads are kept in their places and the arm supported by splints tied round with tape. The fore-arm must then be placed in a sling, but the hand ought to be allowed to hang down, so that a constant extension of the inferior fractured portion of the radius may be maintained, as this very materially assists in keeping the ends of the fractured bones in their proper position. The principal point is to preserve the natural extent of the interosseous space; for if this be diminished, the rotatory motion of the radius upon the ulna will be impeded. When only one bone is broken, the treatment does not differ from that just described, excepting that, in fracture of the lower part of the radius, the hand should be more bent inwards towards the ulna, and kept in that position during the progress of the cure.

Fractures of the bones of the Hand;—the carpus.—The bones entering into the composition of the carpus are so closely united one to the other, that they can scarcely be treated of as single bones, but rather as a compound whole. With very slight motion between each other, they form by their union a strong bony arch, which gives great strength to the part, and affords protection to the important structures of the hand.

Fracture of the carpus can only be the result of the application of a violent direct force, as in the fall of a heavy body on the hand, or gunshot wound; thus it is almost always accompanied by severe contusion and laceration of the surrounding soft parts.

The diagnosis of simple fracture of the bones of the carpus, in consequence of the great difformity which inevitably occurs from the effusion into the soft parts, and from the impossibility of appreciating the crepitus in fractured portions of bones so small as those of the carpus, must always be attended with more or less difficulty. If, however, the fracture be complicated with laceration of the soft parts and splintering of the bones, the fragments must be carefully removed, and the hand placed upon a splint and surrounded with a bandage, to keep the parts steady in their proper position. The chief indication in this accident is to prevent the accession of inflammation in the injured part. At the same time, it must be remarked, that any force sufficient to produce fracture of the bones of the carpus, must also produce injury to the soft parts of such an extensive and destructive character, that amputation becomes necessary in almost every case.

Fractures of the Metacarpus.—The bones of the metacarpus are more frequently broken than those of the carpus, in consequence of their greater length. The fracture of these bones must be produced by the direct application of force—by gunshot wound, for example, or in striking an object violently with the fist; it is also said, that the middle metacarpal bone is sometimes fractured by a fall on the ends of the fingers. When a metacarpal bone is fractured, the broken extremities are drawn forwards and inwards into the palm of the hand by the interossei muscles. The fracture may be simple, or complicated with more or less severe injury to the neighbouring parts; it generally extends to more than one bone, but when one alone is broken, it is ordinarily that of the little finger. In the reduction of this fracture, counter-extension is made on the wrist, and extension on the fingers: a ball must be placed in the palm of the hand, and over this the fingers must be flexed and kept in position by a bandage; the hand must also be placed in a sling, so as to keep the parts perfectly at rest.

Fractures of the phalanges of the fingers, in consequence of their mobility, can only be produced by the direct application of some force upon them; considerable contusion of the soft parts is necessarily concomitant with this fracture, which is easily recognised by the mobility of the parts, by crepitation, and by the deformity which is produced by the drawing forwards of the inferior portion of the bone.

Simple fracture of the phalanges is without any particular importance, but when the fracture is complicated with contusion of the soft parts, or crushing and splintering of the bone, dangerous inflammation, or even tetanus, may follow. The treatment consists in extending the fingers, and applying pasteboard splints and a roller, at the same time putting the hand in a sling to keep it in the necessary state of rest.

It may be further remarked, that when the extreme phalanx is broken, from the small size of that bone, as well as from its having attached to it the nail and its secreting apparatus, it is better at once to amputate the fractured part, than to attempt to save it, as the process of reparation is extremely slow and uncertain.

LECTURE XXII.

CONTINUATION OF FRACTURES OF LONG BONES.

Fracture of the femur—Direction in which the fractured portions are drawn by the muscles — Fracture of trochanter major — Difficulty of diagnosis—Case—Fracture immediately below the trochanter minor—Treatment—Fracture of the middle of the thigh-bone—Diagnostic marks—Treatment—Transverse fracture above the condyles—Diagnosis—Treatment—Non-union from motion of the fractured extremities—Formation of supernumerary joint—Mode of counteracting this tendency—Fracture of the neck of the femur—Frequency of the accident in old age—Predisposing cause of fracture—Natural changes in the neck of the thigh-bone —Diagnosis—Resembles dislocation of the femur on the pubes—Distinctive marks of—Two different doctrines as to mode of reparation — Sir Astley Cooper's doctrine — Treatment— Comparative analysis of the shaft and neck of femur.

FRACTURES OF THE BONES OF THE LOWER EXTREMITY.

Fracture of the Femur.—The femur is the largest, strongest, and hardest bone of the skeleton, constituting about one-fifth of its whole height: it has constantly to support a very considerable weight, and is acted upon by some of the most powerful muscles of the body. Notwithstanding its great strength, the femur, as well as the other cylindrical bones, is liable to fracture in every part of its length, either at the point of the immediate application of a force, or in the centre, from the effect of a fall upon the condyles. Owing to the number of the muscles attached to this bone, it is obvious that the direction in which the fractured portions are drawn will vary according to the specific muscular excitation: we must, therefore, consider separately those parts of the bone which, when fractured, take certain invariable directions. I shall not, however, speak of fracture of the neck of the thigh-bone until after I have described the accidents to which its other parts are subject, as many peculiarities appertain to the lesion of this epiphysis, which render it worthy of distinct consideration.

The first of the fractures of the femur which I shall describe, is that of the *trochanter major*. This apophysis is sometimes separated from the shaft of the bone; but it is extremely difficult to distinguish the accident, owing to the small size of the detached portion of bone, and from its not producing any alteration in the form or length of the injured limb. The disrupted trochanter is drawn so far upwards by the powerful action of the glutei muscles, that it is a work of much difficulty to produce coaptation, even after the true character of the accident has been ascertained. I once met with an instance of the difficulty of forming a diagnosis in this accident: a patient of Mr. Gaitskell of Rotherhithe, had been thrown out of a gig, and had so severely injured the hip as to be incapable of moving the leg, or supporting the weight of the body upon it without suffering acute pain. By the most careful examination I could not discover any fracture; and it was not until after many subsequent investigations that I accidentally ascertained the nature of the injury, in producing excessive abduction of the injured limb, which approximated the fractured portions, and enabled me to detect the crepitus. I immediately confined the parts in the necessary position, and adjusted bandages so as to press the detached portion of bone downwards, and maintain it in coaptation with the shaft: by this treatment I succeeded in effecting ligamentous union, but the function of the thigh-bone was permanently impeded, and the patient always experienced a slight halt in walking.

Fracture immediately below the *trochanter minor* differs from other injuries to the thigh-bone, in the circumstance of the displacement of the upper fractured portion greatly exceeding that of the lower: this arises from the action of the psoas and iliacus muscles, which draw the upper part of the broken bone so much forward as to form a tumour in the groin. The displacement in this fracture can only be obviated by placing the patient in a half-sitting posture, which must be maintained during the whole progress of reparation. Some surgeons recommend that the thigh should be raised upon a double-inclined plane, in order to relax the muscles: the chief objection, however, to this plan is, that sufficient command of the lower portion of the fractured bone cannot be obtained; and, as it requires continued extension to prevent its being drawn upwards and inwards by the triceps muscle, I prefer the half-sitting posture, and the application of Dessault's long splint; a method of treatment which I have adopted for a considerable time, both in public and private practice, with a degree of success that leads me to consider it the most advantageous that can be employed.

When the fracture is in the *middle of the shaft* of the thigh-bone, one of the principal symptoms is the shortening produced by the action of the attached muscles. The extent of shortening depends upon the obliquity of the fracture; if it be transverse, the upper and lower portions of the bone may remain in such contiguity as to entirely prevent longitudinal displacement: but a salient angle is formed outwards, producing a horizontal deformity, owing to the preponderating influence of the vastus externus muscle.

The longitudinal deformity is best corrected by the application of Dessault's long splint, while the horizontal fracture may be treated by thigh-splints; the limb being at the same time placed over the double inclined plane.

When fracture occurs immediately *above the condyles*, the size of the bone in great measure prevents displacement; and if the knee-joint be flexed over an inclined plane, so as to relax the gastrocnemii, plantaris, and poplitæus muscles, the adjustment of the fracture may be readily maintained by the application of pig's-skin, or paste-board splints. At the same time care must be taken to overcome any inflammatory tendency that may manifest itself in the structures of the knee-joint, which is likely to become implicated from its close proximity to the injured part: precisely the same treatment is indicated when the fracture extends *through* the condyles, but more attention must be paid to constitutional measures, as in this case the joint is necessarily involved in the accruing mischief. Fracture of the thigh-bone must be considered more important than that of any other long bone of the body, in consequence of the extensive injury to other structures invariably produced by the violence necessary to effect the fracture of this bone; in addition to which, the great strength of the attached muscles renders it extremely difficult to maintain the coaptation of the fractured portions.

In fractures of the femur, the attention of the surgeon must be devoted as much to the constitutional disturbance likely to result from the injury, as to the mechanical appliances employed for the purpose of preventing deformity.

Success does not, however, always attend the employment of the means I have laid down as best adapted to secure union after fracture. Circumstances will sometimes arise which retard materially the desired result, and it is not always within the power of the surgeon to control and overcome them. Motion of the fractured extremities of the bone will sometimes, notwithstanding every precaution, keep up a degree of irritation sufficient to interfere with the effusion of plastic matter, and consequently prevent the formation of provisional callus; even, indeed, after the latter has been completed, motion of the parts appears to be capable of converting it, by a softening action, into a membranous sac, somewhat resembling a capsular ligament. The extremities of the fractured bone may also undergo a change which unfits them for entering into bony union, and the fracture consequently becomes converted into a supernumerary joint: a similar effect may also be produced by constitutional deterioration which interferes with the elimination of phosphate of lime. Various means have been proposed to remedy these defects in reparation, but, whether they proceed from constitutional or local causes, they ought to be counteracted by prophylactic treatment. The constitutional tendency is to be obviated by strict attention to diet, and by the employment of the means that appear most likely to improve the digestive powers, more especially in supplying such nutriment as contains a considerable proportion of the elements of bone-earth. Mercury has also been successfully prescribed for the purpose of producing an altered condition favourable to bony union. I was first informed of the influence of this medicine in such cases, by Mr. Colles of Dublin, and immediately, upon his recommendation, I tested its effects in a case of fractured humerus in a female, which had remained ununited for seven months: its effects were highly successful, but at the same time I must inform you that in two other cases in which I have since tried it, it altogether failed to produce the desired result. In the former case I fully ascertained that no syphilitic taint existed to account for the success of the remedy. The interruption which motion sometimes causes to the adhesive process can only be overcome by maintaining perfect rest; should this, however, fail, and a supernumerary joint still be formed, surgical means must be resorted to, in the hope of ultimately effecting ossific union of the part, but it is prudent to adopt the least severe measures that appear likely to be effective. It has been already remarked that atrophy of bone often proceeds from disuse, and we may therefore be led to believe that the rest inseparable from the treatment of fracture would, in some constitutions, produce this result; and when union has not taken place after the usual time has expired, it is proper to endeavour to restore the normal nutritive action in the bone through the stimulus obtained by exciting its natural function; this may be effected by permitting the patient to exercise the limb very slightly, after an apparatus has been so carefully adjusted as to entirely preclude the possibility of displacement: it is likewise necessary that the fractured extremities should be pressed together by the application of a constant force, which mechanically produces the close apposition necessary to the excitation of the reparative action. I have frequently known this treatment produce the best result in a week or two, when the usual means had left a fracture in a state of non-union after the lapse of several months: should this method, however, not prove successful, it is recommended by some to pass a seton between the fractured extremities of the bone. I have myself tried this in several cases without success, and believe that if the seton be employed it should not be passed between the broken portions, but through the tissues in the neighbourhood of the fracture, so as rather to excite the formation of provisional than that of definitive bone. Sawing off the ends of the fractured bone, and then producing coaptation, and proceeding as in ordinary cases of fracture, is sometimes had recourse to. This operation appears to me, however, to be fraught with danger, for it converts a simple into a compound fracture, inflicts extensive injury on the soft parts, and must, in my opinion, diminish the probability of reunion in a constitution which, under more favourable circumstances, had already proved itself incapable of effecting reparation. Motion in the fractured extremities of a bone may sometimes fall short of preventing union, but may lead to permanent deformity by interrupting the just coaptation of the parts: it may require a surgical operation to rectify this defect. My colleague, Mr. Key, lately performed a most successful operation in a case of this description, cutting down upon, and sawing through, a badly united fracture, and by resetting he converted the deformed into a symmetrical and perfectly useful limb. Mr. Bowman, of King's College Hospital, has also lately performed a similar operation with perfect success.

Should all the means that I have detailed fail in re-establishing the bony continuity, and the supernumerary joint remain as a permanent defect, amputation is the only alternative left to the surgeon.

Fracture of the Neck of the Femur within the capsular ligament.—It has long been a matter of dispute amongst surgeons, whether fracture of the neck of the thigh-bone within the capsular ligament can re-unite by bone: it is of the highest importance that this question should be settled, as the treatment to be adopted for the alleviation of the injury depends wholly upon the decision.

The treatment now employed is of two kinds, which differ widely in their character and objects; these differences in practice arise from corresponding differences in opinion respecting the nature and consequences of the accident; and as it is most essential that you should be acquainted with the two doctrines, I shall, after having described the appearances which are produced in this accident, briefly relate the grounds of the diversity of opinion.

Fracture of the neck of the thigh-bone within the capsular ligament is a very common accident in old age, and is usually caused by some very trivial external force, such as merely striking the foot against an obstacle while in the act of progression. This yielding condition depends upon a change which the neck of the thigh-bone undergoes in advanced age, namely, a failure in the deposition of earthy matter; a true condition of atrophy, in which the animal constituents preponderate.

To prove this, you have only to examine the thigh-bones of old people, when you will always find the head more or less depressed, instead of being supported by the neck of the bone at the angle of 45° from the shaft, as is the case in adolescence. Not unfrequently the head will be found so much depressed as to encroach on the trochanter minor, and with this change comes the concomitant liability to fracture, or, as might be more properly said, rupture.

The fact that the neck of the thigh-bone almost always undergoes this change as age advances, is, in my opinion, fully established in the published results of Sir Astley Cooper's practice. He mentions, that out of two hundred and twenty-five cases of fracture of the neck of the thigh-bone entirely within the capsular ligament, two of them only occurred before the age of fifty years, and that one of those patients was the subject of aneurism of the iliac artery; so that it may be justly considered that the age of the patient, and the circumstance of the accident being caused by the operation of a very slight force, constitute the principal diagnostic marks of this fracture.

Having spoken of the predisposing and exciting causes, I shall now describe the diagnostic marks of the injury, which are, in fact, so distinct, that it is easy to form a correct opinion of its nature. The history of the case, of itself, may furnish strong presumptive evidence; as, for instance, if a very slight blow, or other force, had produced the entire loss of the use of the limb in an old person. But there are other symptoms which require investigation, and for this purpose the patient should be placed on his back in a hard bed, great care being taken that the anterior and superior spinous processes of the ilia are on precisely the same horizontal plane, when it will be immediately observed that the affected limb is shortened to an extent depending upon the length of time which has elapsed since the occurrence of the accident. It is usually shortened from one to two inches immediately upon the separation of the bone, but the shortening gradually increases to three or even to four inches, according to the muscularity of the patient, and the efforts which have been made to support the weight of the body upon the limb; in this accident the foot, and in fact the whole of the extremity, is everted, so that the heel is raised above the malleolus internus of the opposite limb.

Even with these strong characteristic marks, a surgeon should hesitate in forming his diagnosis at once, as all the symptoms yet detailed may result from a dislocation of the femur upon the os pubis; the age of the patient, and the slight force producing the injury, alone being incongruous with that accident. The grand distinguishing mark, however, is the facility with which the surgeon can, by a slight extending force, bring the fractured limb to the same length as the sound one, while in dislocation it is so fixed that no force less than that which will reduce the dislocation can produce a like effect. While the extension is maintained, the surgeon should place his hand upon the trochanter major of the injured side, at the same time that the assistant rotates the limb; this will cause a sensation of crepitus to be communicated. A further strong diagnostic mark may be obtained by the surgeon placing a hand on each trochanter major whilst the assistant rotates both limbs simultaneously; it will then be perceived (if fracture of the neck of the thigh-bone has occurred) that the trochanters move in arcs of different circles, that on the sound side describing an arc of which the neck of the bone forms a radius, whilst that on the side of the injury merely rolls, as it were, on its own axis; besides this, it is almost impossible for the patient to raise himself in the sitting position in the bed, in consequence of the thigh-bone having lost its *point d'appui* in the acetabulum. The diagnostic marks of the accident are, indeed, scarcely to be mistaken, and as they are also generally concomitant, there is but little difficulty in accurately establishing the diagnosis. To speak of the prognosis is a much more difficult task, and before I attempt to do so, I shall endeavour to lay before you the views which particularize the differing opinions of surgeons on this important subject.

There are some pathologists who believe that fractures within the capsular ligament unite by the same process of reparation as that employed by nature in lesion of the other parts of the osseous system, necessarily inferring that the structure and organization of each is identical. It follows, of course, that those who hold these opinions employ the usual means adopted in the treatment of fracture, such as extension, application of splints, and other mechanical means, to obtain that union between the broken extremities which they regard as equally possible here as in other cases of fracture.

The second doctrine, which Sir Astley Cooper was the first to promulgate, is essentially different from the last. He maintained that nature is opposed to the osseous reunion of the fractured neck of the thigh-bone within the capsular ligament, excepting in cases in which the periosteum of the neck has not been torn through, so that the two fractured portions still remain in perfect apposition: but even under these circumstances they only unite by a similar process to that which occurs in the reparation of the bones of the head, namely, without the formation of any provisional bone. In cases in which the fractured ends of the bone remained in perfect apposition, there could be none of the usual symptoms of shortening, eversion, or crepitus, by which the surgeon could form his diagnosis; and should he even suspect solution of continuity, he could recommend nothing beyond perfect rest in the recumbent posture.

These conflicting doctrines appear to be essentially different in character, and they must, therefore, affect, to a very important extent, the course to be adopted in reference to the treatment of fracture of the neck of the thigh-bone. Considering the frequency of the accident, it becomes the duty of the practical surgeon to make himself thoroughly acquainted with the controversies on this subject, in order that he may be able to decide more correctly upon the course of treatment likely to lead to a fortunate result, when called upon for the application of his knowledge; and he is the more bound to devote some attention to this matter, because even those who maintain the possibility of osseous union admit, that with all their mechanical contrivances they very rarely succeed in effecting their object. I think, indeed, it is not difficult to show that it is a principle of nature to prevent rather than to establish the ossific reunion of the parts.

In my opinion, old age must be considered as one of the principal causes of non-consolidation of the neck of the thigh-bone after fracture; for not only is there the want of reparative power inseparable from an advanced period of life, but also the peculiar change which had taken place in this part of the body before the occurrence of the accident; and it is inconceivable how the reunion of the parts can be expected, when they have already proved incapable of preserving their continuity against the operation of the slight force which was sufficient to produce their fracture. It must be remembered that the surrounding cellular membrane assists in the process of the reparation of bone, as well as in the original formation of the osseous system, and this is effected partly by the influx of an additional quantity of blood to the wounded periosteum, which leads to ossific inflammation. In cases of fracture of the neck of the thigh-bone within the capsule, (where the periosteum is torn through,) there is no surrounding tissue capable of assisting in the process of reparation, so that the head, and that portion of the neck remaining attached to it, is cut off from all supply of nutriment, excepting to its articular cartilage and synovial membrane; hence the inability of the vessels (which pass from the ligamentum teres to the detached head) to maintain the action necessary to effect the ossific deposit, must be regarded as the chief cause of non-union when the neck of the thigh-bone is broken. If, however, the fracture takes place without the concomitant rupture of the periosteum, the parts may perhaps be reconsolidated by bone, as in that case the supply of blood required for the restoration of the parts is not cut off, and the periosteum would limit the deposit of bone-earth so as to prevent that redundancy which would interfere with the functions of the hip-joint.

The ligamentous union by which fracture of the neck of the thigh-bone is generally repaired, seems to be the result of the peculiar organic character of the parts themselves, and not to arise from failure in the operation of the means employed by the surgeon; and, indeed, bony union of the neck of the femur, when broken, appears to be incompatible with its natural structure. Non-union has, however, been ascribed to various causes, such as imperfect coaptation, absence of continued pressure, and the effect of synovia on the broken extremities. The two first of these may be easily overcome by continued extension and the application of a circular bandage, compressing the injured trochanter towards the head of the bone; as to the third, I do not myself believe that the presence of synovia prevents the ossific deposit.

The treatment of fracture of the neck of the femur must be regulated according to the age of the patient, and will, of course, depend greatly upon the feeling of the surgeon as to whether he believes that the injury is repaired by the bony or ligamentous union: if he entertains the latter view, he would, of course, abstain from the employment of any apparatus, which would only increase the inconvenience of the patient, and aggravate the difficulties of the case, by confining him to his bed for at least two or three months. In old persons, where the injury has been produced by the operation of a slight force, it will be evident that the lesion is rather the effect of altered structure than of the application of violence. The health of the patient should therefore be sustained in every possible way, and should not be exhausted by harassing attempts to produce ossific union under circumstances in which it does not seem destined by nature to occur. The patient should be laid upon his back, and a bolster placed beneath the limb throughout its whole length, and, at the same time, the knee should be raised by means of a pillow: the degree of extension or flexion will be best indicated by the sensations of the patient, his ease being the best guide to the proper posture. The limb should be left in this position for a fortnight, until, indeed, all pain and inflammation have subsided. The patient may then be allowed to sit out of bed in an easy chair; and when, after a time, he experiences a consciousness of being able to support some portion of his weight upon the injured limb, crutches may be given to him, and he should be directed to gradually make use of it. This exercise will tend to strengthen the ligament and muscles, the employment of the natural functions being the best stimulus to reparation. By this treatment, patients are usually convalescent in about three months, being then capable of walking with a stick, and, although halting, they retain a considerable degree of usefulness in the limb.

If a younger patient, in full vigour of life, should, from the application of considerable force, sustain an injury to the hip-joint, producing the symptoms which I have described, I should then submit the patient to the extended position, and the means to produce coaptation, from the hope that the fracture may have been partly external as well as internal to the ligament. Under these circumstances ossific union will consolidate the fracture external to the ligament, but still nothing beyond ligamentous union is effected within. The diagnostic marks of fracture external to the ligament are,—the age of the patient; the degree of injury to the soft parts from the violence necessary to produce the accident, as indicated by immediate swelling and ecchymosis; the excessive pain produced by the slightest motion, and the readiness with which crepitation is felt upon the extension of the limb;—symptoms requiring active constitutional and local means to subdue them. It sometimes happens, as has been already mentioned, that difficulties arise in the diagnosis of fractures of the neck of the thigh-bone in cases in which there is neither shortening, eversion of the limb, crepitus, nor any difference in the arcs described by the rotation of the trochanters. This absence of symptoms arises from the periosteum of the neck not having been torn through. There can be no reason why, under such circumstances, reparation should not be effected by definitive ossific deposition; but, from the absence of symptoms, the nature of the accident never having been suspected, there are but few opportunities of investigating it.

I subjoin a series of experiments which I made, in order to ascertain the precise nature of the change which the neck of the thigh-bone undergoes in old age, that I might discover the cause of its tendency to fracture from such slight injuries as are known to produce its solution of continuity. The specimens of bone were selected with great care, and portions being sawn off, were weighed, and then burnt in a muffle, so as to destroy the whole of the organic matter, and, being again weighed, the result was recorded. The quantity of bone taken in each case weighed from 150 to 300 grs. The relative proportion of phosphate and carbonate of lime was ascertained in several instances, but no perceptible difference worthy of notice was observed.

The following table presents the average of six experiments in each case:—

Recent neck of old femur	31·3	Per-centage of bone-earth.
Shaft of same bone	53·3	
Recent neck of femur, middle age	50·1	
Shaft of same bone	56·7	

So that it appears that, although the recent neck of middle-aged bone contains 50 per cent. of bone-earth, yet the recent neck of old bone yields only 31 per cent.; while, at the same, the difference between the shafts is by no means so great, being 56 for middle age, and 53 for old bone. In all it was found, however, that the shaft contains more bone-earth than the neck.

From this view it would appear that the changes which occur in the neck of the thigh-bone, and indeed in all the epiphyses at advanced periods of life, result from the inability of their capillaries to eliminate the earthy constituents from the blood; and they are therefore composed of an undue proportion of animal matter, which is more readily secreted.

Under these conditions we find also a tendency to bone-earth deposits in the more highly vitalized structures—such as the aorta, lungs, and prostate gland, giving rise to ossification or phosphatic calculus—diseases so frequent in old age, a period at which we are led to expect a want of power in the less vitalized structures of the body, and more particularly of certain parts of the osseous system.

These experiments may serve to prove that we ought not to expect bony union in such situations, and that it becomes next to impossible after the middle period of life, as there then ensues the difficulty of the capillaries of the osseous system to appropriate the earthy constituents of the blood to the use of bone, and more especially in those which are not covered with periosteum.

LECTURE XXIII.

CONTINUATION OF FRACTURES OF THE BONES OF THE LOWER EXTREMITY.

Fracture of the patella—Differs from that of long bones—Transverse fracture—May take place by the action of muscles—Diagnosis—Treatment—Oblique or longitudinal fracture—Treatment—Fracture of the bones of the leg—How generally produced——Circumstances usually attendant upon such fractures—Displacement of the ends of the broken bone—Fracture of the tibia—How recognised—Treatment—Concomitant injuries—How they may influence the cure of the fracture—Fracture of the fibula—Diagnosis—Indications—Fracture of the bones of the foot—Reason why they are little liable to fracture—How fracture of these bones may be produced—The os calcis may be broken by the action of muscles—Diagnosis—Treatment.

Fracture of the Patella.—The fractures of this bone, as well as those of certain portions of the long bones, require distinct consideration, inasmuch as their mode of reparation differs from that I have already described, in consequence of their deriving their nutriment from a different source to that of the bones generally, as well as from the great difficulty in maintaining the coaptation of the separated portions when they are broken.

The patella may be fractured transversely or obliquely; the longitudinal fracture but rarely occurs, and this is explained by the circumstance that this bone is most frequently broken from a sudden and violent action of the extensor muscles. But the patella has an office to perform, (besides that of directing the concentrated force of the extensor muscles of the tibia,) which is not unfrequently the cause of its being injured; it has, in many positions of the body, as in kneeling, to protect the knee-joint, so that in falling it is frequently driven with great force to the ground, and receives an oblique or longitudinal fracture. It sometimes occurs that the ligament of the patella, or the tendinous insertions of the muscles into it, give way rather than the bone itself; *à priori*, it might be supposed that such would be the most frequent accident; but the slight degree of extensibility of these parts, compared to the brittleness of bone, renders the latter more frequently the subject of injury. When the patella is broken transversely by the action of the muscles, the most ordinary cause of this violent action is well explained by Boyer, whom I shall quote. "To form a correct idea of the manner in which the fractures of the patella take place from the action of muscles, it should be remembered, that the erect position is the firmest possible, when the centre of gravity is in a line perpendicular to the base on which the body is supported; it also happens, that although the line of gravity may cease to be perpendicular, that still, by the action of muscles, the erect posture may be maintained. If the centre of gravity be suddenly thrown from the perpendicular, (and we will suppose in a direction behind the base,) as suddenly, and with a force proportionable to that which renders the action necessary, must the extensor muscles of the leg act so as to bring the trunk forwards, and restore the centre of gravity to the perpendicular: it is under this sudden and violent impulse that the bone usually gives way transversely. Thus a person riding behind a carriage, and jumping off with his back towards the vehicle, has a tendency to be thrown backwards by the vis inertiæ of his body, when, by the violent contraction of the extensor muscles of his leg, the accident occurs."

The diagnostic mark of transverse fracture of the patella is easy. Immediately upon the infliction of the injury, the patient loses all power of advancing the foot of the injured side, and if he has fallen, which he will necessarily do if he attempt to walk, he is perfectly unable to rise without assistance; but he can move in a retrograde manner, by drawing the soles of his feet along the ground, but taking care not to bend his knees. Upon examination it will be found that the upper portion of the fractured bone is separated from the lower to a distance proportionate to the laceration of the capsular ligament and tendinous aponeurosis covering the bone, so that it may differ from half an inch to four inches and a half in extent. There will also be found, in the front of the knee-joint, a depression instead of the natural prominence of the patella, and, by a very slight degree of pressure, the hand seems as if it would sink into the joint; further, by perfect extension of the leg upon the thigh, at the same time flexing the thigh upon the pelvis, the detached portion of the patella may be brought down to that fixed to the ligamentum patellæ, and a crepitus be felt. Such are the diagnostic marks of fracture of the patella, and in cases of simple fracture the prognosis is favourable, although the appearance of the joint would lead an unexperienced eye to the suspicion of extensive injury, from the degree of swelling caused by the effusion of blood, and the inordinate secretion of synovia, arising from the inflammation of the tissues of the joint.

Although I have described the prognosis as favourable in this accident, I mean so in reference to the constitutional symptoms and preservation of the limb: as far as refers to the joint itself, the perfect restoration of its function cannot take place, as ossific consolidation of the patella very rarely occurs after a transverse fracture. This is proved by numberless examinations of the living, and by dissection after death; still, however, the object is the same as in other fractures, viz., to employ such means as will not only produce perfect coaptation, but maintain the bones in the proper position.

The treatment, therefore, consists in perfect extension of the leg upon the thigh, and flexion of the thigh upon the pelvis, so that the limb is placed at an angle of thirty degrees with the horizontal line of the trunk; or the patient's body may be raised to the sitting posture, which will equally relax the rectus muscle. The extensor muscles are now to be gently drawn down by the hand, and a bandage rolled around the thigh, for the purpose of giving them support and diminishing their irritability, and this fixes at the same time the upper portion of the patella. The bandage may be continued from the thigh to the leg, and from the leg back again to the thigh, passing behind the knee-joint, so as to cross in the ham for several turns, in the form of the figure eight, thus embracing the sides of the patella; it may then be continued to the foot as a common roller, to prevent the swelling which would otherwise occur from the partial compression. A circular strap should be buckled on above, and another below the fractured patella, and these made to approximate by means of side straps; a long hollow splint, well padded, so as to produce equable pressure on every part, should reach from the ischium to the heel; and if this apparatus is well adjusted, every motion of the knee-joint is entirely prevented. As to the constitutional and local remedies which are to be employed, they must be regulated by the urgency of the symptoms: if much inflammation of the joint supervene, leeches and fomentations must be used, all pressure of the limb by bandages taken off, and evaporating lotions kept constantly applied. If the constitution becomes affected, which would be indicated by irritative fever, white tongue, quick pulse, and heated skin, saline medicines, with calomel and opium, will be found of great use. Such symptoms rarely occur, however, unless the fracture be compound; but even under those circumstances, the treatment will in no wise differ from what has been described, unless the injury be so severe as to render amputation necessary; in that case the surgeon must quickly decide, as it will be too late if violent inflammation in the knee-joint has once commenced.

In simple fracture of the patella, after the apparatus has been applied from five to six weeks, passive motion should be commenced in the knee-joint, and should be increased gradually every day, until perfect flexion of the limb be restored.

In oblique or longitudinal fractures of the patella, the same treatment is required as in the transverse fracture—at least, if the obliquity be sufficient to permit of the separation of the two fractured portions; but if it be perpendicular, there need be no separation of the two portions of the bone, and possibly no other immediate symptom than the pain produced by the infliction of the blow; so that the diagnosis would be extremely difficult, and the nature of the accident probably escape detection and be treated as mere contusion. According to the experiments made by Sir Astley Cooper on the lower animals, when a perpendicular fracture was made through the patella it was found that it united by bone; so also in transverse fractures, when they were so produced that neither the tendinous expansion on the bone nor the capsular ligament was torn through; consequently the fractured portions were not separated, placing the pathology of fracture of the patella under precisely the same circumstances as that of fracture of the neck of the thigh-bone.

After fracture of one patella, the patient should be warned of the liability to fracture the other, in consequence of the loss of equality of power in the extension of the two limbs; so that, in walking, the foot of the injured side is liable to catch against the ground, throw the patient on the opposite knee, and thus produce a similar accident in it.

Fractures of the Leg.—Fracture of the bones of the leg generally results from the direct application of force, or from a fall on the feet. A heavy weight falling on the leg, or the pressure of the wheel of a carriage passing over it, may fracture the bones at the point at which the force is applied; both bones are then broken at the same height, and the fracture is generally transverse; but it may be comminuted and complicated with contusion and laceration of the soft parts. If a violent blow break the tibia only, the individual being standing, the fibula may be broken secondarily, for after the fracture of the tibia, the fibula alone has to support the weight of the body, and sometimes gives way under it. Although there is a great analogy between the bones of the fore-arm and those of the leg, as to structure, there is this difference between them with respect to their fractures—in the leg it generally happens that both the bones are broken at the same time, while, in the fore-arm, it is more usual for only one to be injured: it must be obvious that this depends upon the difference in the manner of the articulation of the bones. In the fore-arm the radius is most frequently broken alone, because, from the manner in which it is articulated with the wrist, in a fall on the hand it receives the whole weight of the body. With the ulna it is different, for as that bone is not directly connected with the hand it escapes the shock which would otherwise be sufficient to break it. In the case of the bones of the leg, a violent force applied to the foot, as in jumping from a height, is communicated at first to the tibia, which may give way. Then, as I have already said, the whole weight of the body is thrown on the fibula, which is generally broken in its turn. When both bones are broken, a diagnosis is easily formed from the pain, loss of motion, deformity, and crepitus on rotating the foot.

The position of the fractured bones is generally angular, the upper portion being drawn forwards and inwards, and the lower backwards and outwards, by the muscles of the calf of the leg. Longitudinal displacement seldom occurs, in consequence of the extent of surface presented by the fractured bones, unless the fracture be very oblique, when some shortening may occur. The diagnosis of the fracture of both bones of the leg is easy: shortening of the limb, deformity from projection of the superior fractured extremity, mobility, crepitation (always easily distinguished), rotation of the foot on its axis, so that its plantar aspect is turned outwards, are all signs which scarcely admit of misinterpretation. The treatment of fracture of both bones of the leg consists in making extension from the foot and counter-extension from the knee: a very slight exertion of force is usually sufficient to effect the coaptation of the parts; when they are in their proper situation, it may be known by tracing the anterior edge of the tibia with the finger, as the soft parts covering this portion of the bone are so thin as to permit of the least irregularity being detected. While the limb is held in the position requisite to keep the fractured bones together, a long and well-stuffed pad should be adjusted on either side of the leg, so as to fill up all the natural depressions of the limb: over these pads lateral splints must be applied, which ought to be sufficiently long to pass beyond the foot, so that all motion may be prevented, for it is chiefly from the movement of the foot that displacement of the broken bones is likely to occur. The splints used in this accident are sometimes furnished with what is called a foot-piece; but the long splints answer equally well. A third splint may be applied to the anterior part of the leg; this not only assists in keeping the bones in their proper position, but forms a good defence to the leg against the tapes used in securing the lateral splints. The limb may be supported either upon the side or upon the back, according to the circumstances of the case; if upon the back, care must be taken to support the limb in every part. This may be managed by means of bags of bran or dossils of lint; the heel must neither be depressed nor elevated, as, in the first case, the lower portion of the fractured bone would be thrown forwards, and, in the second, it would form a salient angle backwards. It may be always ascertained whether the parts remain in juxtaposition by the direction of the great toe, which ought to lie in a line with the centre of the patella. Contusion and laceration of soft parts are very frequently concomitant with fracture of the bones of the leg: if this be the case, a daily examination of the wound will be necessary; the limb should, therefore, be placed in such a position that the injured parts may be exposed to view without risking the disturbance of the adapted fracture: which may be effected by having the apparatus constructed so that the wounded part may be seen; for instance, the splints may be made with hinges either at the back or sides.

Fractures of the Tibia.—Fracture of the body of the tibia is most frequently due to the operation of a direct force, in which case it is generally transverse; but if it be caused by a fall on the feet, its direction is more frequently oblique. It is more difficult to discover fracture of the tibia alone, than that of both tibia and fibula; to detect the fracture of the tibia, the surgeon should pass his fingers along the anterior edge of the bone; this examination will render the slightest displacement evident; or, having fixed the superior part of the leg, if there be fracture, it may be ascertained by a certain mobility which will exist in the lower portion of the tibia; lastly, crepitation may be produced by slightly rotating the foot. The reduction of this fracture is generally easy, the treatment being the same as when both bones are broken; when the fracture occurs at the superior part of the tibia, the proximity of the knee-joint must much influence the prognosis and treatment of the injury, particularly as the strength of the bone at this part is such as to require a violent exercise of force to produce its fracture: in consequence of this, the mischief generally extends to neighbouring parts as well as to the bone.

Fractures of the Fibula.—When the fibula alone is fractured, and much swelling ensues, it is often difficult to discover the fracture, particularly as the patient may be able to walk after the injury.

In whatever direction the bone may be broken, there is no longitudinal derangement, but the ends are drawn in towards the tibia.

Fracture of the fibula may be overlooked if it occur above the inferior fourth of the bone; and often, under those circumstances, a knowledge of the cause of the accident, and the fixed pain and swelling, are the only marks which the surgeon can obtain; there is neither displacement nor consequent difformity, and very often crepitus cannot be felt. When the fracture is lower, that is, just above the malleolus, an attentive examination rarely leaves a doubt as to the nature of the accident; the direction of the foot, the depression over the external malleolus, the deformity, and the crepitus, which may generally be felt in this fracture by pressing the fractured extremities inwards, are all sufficiently strong diagnostic marks. This fracture is frequently produced by the foot being forcibly driven outwards, so that the astragalus striking violently against the malleolus externus, the bone gives way, as I have just described, where it is united to the shaft. In the treatment of fractures of the fibula, the splint should project beyond the foot, to prevent rotation of the latter, but, in other respects, it is similar to that already laid down in speaking of fracture of both bones of the leg.

Fractures of the bones of the Foot.—The bones of the foot are but little liable to fracture, in consequence of their conformation, mode of articulation, and structure; indeed, all the circumstances which have been described as naturally tending to preserve the bones of the hand from injury of this kind, relate even more strongly to the bones of the foot, with the single exception of the os calcis. The *Os Calcis,* from the manner in which it projects posteriorly to receive the insertion of the extensor muscles, may be broken either by the contractile force of the gastrocnemii muscles, or from the application of a blow: with regard to the muscles, it ought to be remarked, however, that it is much more frequent for the tendo Achillis to be ruptured, than the os calcis broken by their action. Although, of all the bones of the tarsus, the calcis is most likely to be fractured, the accident is still a rare one: but there can be no doubt that it may be produced both by the action of muscles, and by a fall from a considerable height on the foot. The nature of the accident may be known by the following symptoms; at the moment of the fall or blow, a distinct crack is felt in the heel, which is followed by a sharp pain; the patient cannot walk, nor indeed move the foot; the posterior part of the calcis will be found to possess an unnatural mobility, and during its motion, crepitus may be felt. Separation of the fractured portions is not very readily ascertained, in consequence of the thickness of the integuments of the foot. The treatment of this fracture consists in extending the foot, and bending the knee, so as to relax the tendo Achillis; indeed, the treatment is much the same as that in rupture of the tendon itself, excepting that the pressure of a bandage is required to keep the fractured portions of bone in complete apposition.

The other bones of the tarsus are subject only to comminuted fracture; the same may be said of those of the metatarsus and phalanges of the toes, the indications being in these cases similar to those in fracture of the bones of the carpus, metacarpus, and phalanges of the fingers. As I have already fully described the fractures of the bones of the hand, it would be a useless recapitulation to enter into a detail of the circumstances attendant upon fracture of those of the foot; at the same time, I ought to mention one point of difference in the treatment of fractured phalanges of the fingers and those of the toes: in the former, amputation is more frequently had recourse to, as little short of the complete restoration of the parts will render the fingers useful. On the other hand, anchylosis of the toes is much less important than that of the fingers, inasmuch as an anchylosed toe is still useful in helping to support the body, both in rest and motion.

LECTURE XXIV.

DISEASES OF JOINTS.

Synarthroses—Their character and functions—Tissues entering into their composition—Absence of synovial membrane—Diseases of the synarthroses—Atrophy—Disease of fibro-cartilage—Pelvic articulations rarely diseased, but subject to peculiar congenital malformation—Amphiarthroses—Their composition—Diseases of—Diseases of spine—Diagnosis—Treatment—Diarthroses—Importance of—Composition—Synovial membranes—Diseases of diarthroses—Epiphyses—Their physical character and diseases.

As the joints constitute the apparatus whereby the bones of the skeleton are connected one with another, and also the medium by which the contraction of the muscles is rendered available to voluntary motion; it must be evident to all, that the diseases or injuries to which the joints are liable form a very important and interesting branch of surgery. The next section of my lectures will accordingly be devoted to the considerations connected with the diseases of the joints, wounds of joints, and dislocations.

The joints are divided into three classes—the synarthroses, amphiarthroses, and diarthroses. The synarthrodial joints comprehend those in which the bones are united by fibro-cartilage and ligament, but which are uninfluenced by the action of muscles, and are only capable of that extent of motion which arises from the elasticity of the fibro-cartilage which lies between the connected bones. The articulations or sutures of the bones of the cranium, are the type of joints of this kind. Amphiarthrodial joints resemble the synarthroses in being limited as to extent of motion; but they differ from them, both as to the character of the fibro-cartilage which intervenes, and the ligaments which bind them together; they are also in some measure under the influence of muscles: the articulations of the bones of the spine with each other are the type of this species of joint. The diarthrodial joints are different from either of the others: in these, the bones are not united, but merely bound together, as it were, by the ligaments, each bone being furnished with its articular cartilage respectively; the joint having a great extent of motion, and, to prevent friction, being lubricated by a specific fluid—synovia. Diarthrodial joints are under the immediate influence of voluntary muscles: the knee, or shoulder-joints, may be taken as their type.

Owing to their complicated structure, the number of tissues likely to be implicated when they become diseased, and the important relation which they bear to the functions of the limbs, the joints offer to the surgeon many circumstances of extreme interest, under the influence of idiopathic disease, or local injury.

In speaking of the diseases incidental to the articulations, I shall commence with those of the synarthroses and amphiarthroses, leaving for the present the diarthrodial joints, which, owing to their construction and the circumstance of their falling frequently under surgical treatment, will demand more detailed consideration. Before I begin, however, to describe the diseases of the different classes of joints, I must speak of their characteristics in their normal state, in order that the changes which take place in them under the influence of disease may be better appreciated.

Synarthrodial joints are formed by the approximation and articulation of the edges of the flat bones, which, when thus articulated, constitute cavities to contain organs of great importance to life. The bones of the cranium and pelvis afford the best examples of this description of articulation.

These are technically termed immoveable joints, but the fibro-cartilage which separates the edges of the bones, admits, owing to its elasticity, of sufficient relative motion to prevent the injurious effect of the concussions to which the frame is constantly exposed during the performance of the ordinary functions.

The term ligament is applied to one of the tissues which compose the synarthroses, but it must be understood that this consists merely of an extension of the external and internal periosteum from one flat bone to the other, crossing the suture, and passing over the sutural cartilage. All the tissues which enter into the composition of the moveable joints are present in the synarthroses, with the exception of the synovial membrane, which is evidently unnecessary, owing to the slight degree of motion of which this kind of joint is capable.

The synarthrodial joints are therefore composed of bone, fibro-cartilage, and ligament: and it is evident that the existence of disease in either of these tissues will induce a morbid condition of the joint itself.

Having already described the diseases of the flat bones, I shall now speak only of those which implicate the points of articulation, or the parts which enter into the composition of the synarthrosis.

Inflammation, from whatever cause it may arise, may be productive of such an altered condition of the osseous portion of a synarthrodial joint as to induce absorption of the intervening fibro-cartilage, and ultimately produce anchylosis. This is the general result in cases of hypertrophy. Atrophy, on the other hand, consists in a degeneration in the nutrimental economy to such a degree as to interfere with the constitution of the articulation; this action is frequently met with in cases of hydrocephalus, when the junction between the bones is entirely wanting, owing to the non-development of tissues necessary to the formation of the joint. Abnormal pressure from within the cavity may also produce interstitial absorption of all the intervening structures of the synarthrosis.

Fibro-cartilage, although it forms the intermediate structure of every synarthrosis, differs in texture according to the extent of motion to which the joint is liable: it consists, for instance, of an equal intermixture of ligament and cartilage in the sutures of the skull and sacro-iliac synchondrosis; while the intervertebral substance is formed of true ligamentous matter externally, but in the centre it is pulpy, or nearly fluid. As all fibro-cartilage is extra-vascular, it is difficult to believe that it can be primarily liable to disease; an abnormal condition of this tissue must therefore be attributed to the bone with which it is in connexion. When torn or cut through, fibro-cartilage unites by a process similar to that which operates in the reparation of bone, except that in the case of the former there is no deposition of phosphate of lime; even this, however, happens as the result of old age.

Fibro-cartilage is also capable of absorption, which may be produced by pressure, as by aneurism, or in diseased spine: when the nutrition is diminished, the latter must be regarded as a condition of atrophy.

Fibro-cartilage appears to be susceptible to inflammation under the influence of certain diseases of the bone to which it is attached, and it is sometimes removed by the process of ulceration and suppuration: portions of a fibro-cartilage frequently become detached from the effect of ulceration, and acting as extraneous matter, irritate the surrounding living parts, and no doubt often operate as the exciting cause of psoas and lumbar abscess.

Of the ligamentous structure of a synarthrodial joint, but little can be said; and I shall reserve the consideration of the diseases of ligament until I treat of the diarthroses.

Disease of the pelvic joints is very rare, and when it occurs it is generally the result of accident. These articulations appear, indeed, to be independent of the changes to which the other synarthrodial joints are susceptible in old age, and it is a very rare occurrence to find them anchylosed even in the skeletons of the most aged.

Amphiarthrodial joints.—The bodies of the vertebræ united by the intervertebral substance (which admits of the motion in the bones of the spine, caused by the action of the muscles of the true diarthrodial joints by which they are connected) afford the best example of an amphiarthrodial articulation: these joints are composed of the bodies of the vertebræ, the intervertebral substances, and the anterior and posterior ligaments of the spine.

The spine is very liable to congenital malformation: this is the result of arrest of nutrition during uterine gestation; hence the frequent occurrence of spina-bifida and other abnormal conditions. The whole of the tissues forming the mesian raphe seem to be more prone to congenital malformation than those of any other part of the body; thus we meet with frequent cases of non-closing of the fontanella, hare-lip, deformity of the sternum, imperfections of the linea alba, deficiency of the abdominal parietes in the pubic region, and defects of the organs of generation and the perinæum; the frequency of disease in the spine would also appear to arise from the operation of the same law. The structures of the amphiarthroses are liable to inflammation, which may terminate either in caries, suppuration, or death of the bone: under these circumstances, the joint will become implicated in the disorder, owing to the defective nutrition in the intervertebral substance. This condition is indicated by the following symptoms: there is pain in the vertebral column at the point of the disease, greatly increased by pressure or a blow, and with or without a projection at the part; the sensibility of the lower extremities is diminished, and if the seat of the disease be high in the spinal column, the functions of the upper extremities may also be interrupted; in aggravated cases, there is a tendency to retention of the urine and incontinence of the fæces, indicating pressure upon the spinal marrow; distortion soon results, the spine being bent either forward or laterally, the direction depending upon the part of the bodies of the vertebra at which ulceration has taken place.

In some cases, disease of the spine seems to originate in a scrofulous diathesis, the bodies of the vertebræ becoming softened, and altered generally, and undergoing a process of ulceration, which sometimes begins in the centre of the vertebra, at others, in that portion of its body nearest to the intervertebral substance. In other cases, the ulceration begins in the intervertebral substance itself, and extends to the surfaces of bone with which it is in contact.

Sometimes the vertebræ take on a kind of chronic inflammation, which ultimately implicates the intervertebral cartilage. Suppuration often takes place at an early stage of spinal disease, constituting what is termed psoas, or lumbar abscess; at other times, suppuration does not occur until the disorder has reached a more advanced period; in either case, however, this is the most dangerous termination to disease of the spine.

In persons who have died from spinal disease, the vertebræ are carious and friable, pus being sometimes found throughout their whole texture, the intervertebral parts are diseased, the centre being generally most affected in progressive ulceration: the latter is also of a dark colour, and in protracted cases the theca vertebralis in the vicinity of the diseased bone, likewise becomes implicated. Disease of the spine sometimes terminates in anchylosis, which may be considered as a species of natural action established for the reparation of the parts. Spinal affections are frequently the result of accident, but even then the character of the induced disease depends upon the peculiar constitution of the patient.

Diarthrodial joints.—The diarthroses constitute the most important joints of the body as far as refers to locomotion and the varied functions of the extremities. To render this class of articulations competent to perform the duties for which they are intended, we find them supplied with a tissue not existing in any other description of joint; this is the synovial membrane, a tissue which is destined to secrete a fluid for the constant lubrication of the articular cartilages. Bone, articular cartilage, synovial membrane, and ligament, all enter into the composition of these joints, and each of these structures is from its peculiar physical properties essential to the whole articulation. Bone, from its hardness, affords the requisite strength, and maintains the form of the part; cartilage from its elasticity prevents injury from concussion, and by its smoothness diminishes the friction, which might otherwise produce injurious effects; synovial membrane secretes the fluid intended for the perfect lubrication of the joint, and ligament from its flexibility permits the natural motions, at the same time that its great tenacity serves to regulate that motion, and to maintain it within the limits compatible with the safety of the articulation. Each of these tissues is liable to disease, which if it continues may implicate the whole of the joint. I shall now describe separately the diseases of each particular tissue, and shall commence with those of bone.

The articular extremity of a long bone is undoubtedly composed of osseous matter, although it differs materially in character from the shafts of the bones of the same class. The ephiphysis is not, indeed, connected with the shaft by bone until after the age of puberty, and it does not even then derive its blood directly from the nutrient arteries of the shaft, but through the medium of capillary apparatus, by a kind of exosmose and endosmose, carried on in the interstitial substance of the epiphysis, which likewise receives blood from some small vessels leading from the ligaments of the joint. About the age of twenty, when the muscular system becomes fully developed, the articular extremity of a long bone is hardened into a permanently osseous condition, being still, however, terminated by a coating or layer of cartilage, which is termed the articular cartilage; this is never under any circumstances converted into bone, nor, if once removed by ulceration, is it capable of being reproduced; and it appears to me, that an epiphysis must be considered as an apparatus destined especially for its formation.

The spongy texture and lightness of the articular extremity of a bone permits of its being expanded to sufficient size to furnish a large surface, where the bones constituting the joint are in apposition, without increasing the weight of the parts to an inconvenient degree, a considerable amount of joint-surface being requisite, both for the purpose of rendering the motions of the joint steady, and of diminishing the liability to dislocation.

From the peculiar organization of an epiphysis, it must also appear evident that its diseases and mode of reparation would differ materially from those of the shafts of long bones. We find, indeed, that the restorative action after fracture, resembles very closely the process adopted by nature for the repair of lesion of the flat bones, and the similarity arises from like circumstances, the object being in either case prevention of interference with or injury to the surrounding joint structures. From the natural tendency thus observed, it follows that inflammation in an epiphysis rarely terminates in hypertrophy, but in caries, abscess, scrofulous deposit, and sometimes necrosis, without, however, any formation of provisional bone in the latter case.

Atrophy in epiphyses of the long bones may be the result of any cause which interferes with the process of nutrition; hence we find it of frequent occurrence at an early period of life, when there is much liability to disease of the joints generally. The atrophy, which occurs as the consequence of the constitutional deterioration incidental to old age, can scarcely be regarded under the head of disease, although the effect is one equally productive of suffering and inconvenience to the patient. The change experienced in the neck of the thigh bone in old age, affords the best example of the latter kind of atrophy, and the neck of the thigh bone may be regarded in this respect as typical of the epiphyses.

In caries of the vertebræ, the principal point to be attended to is to preserve the parts in a state of the most absolute rest; the slightest motion of the vertebræ upon each other is sufficient to interrupt the reparative efforts which nature makes under such circumstances, and to increase the inflammation; and whilst the patient is allowed to move about, the friction of the parts, however trifling, will serve to keep up the ulcerative action, and favour the progress of the disease towards suppuration. The first step, therefore, in the treatment of this disorder, is to confine the patient altogether to a couch or bed, and to place him in such a position that even the most trifling degree of motion in the spinal column will be prevented; generally speaking, it is better that he should simply be in the supine position, as, whenever the spinal curvature results from disease in the bones, nothing can be more injurious than the application of any mechanical apparatus to straighten the spine; such treatment is in direct opposition to the action which nature carries on to remove the disease, and can, in my opinion, only be productive of evil consequences. It is true that immobility may be maintained either by means of a Dessault's splint or a bandage with whalebone splints; but the object in the use of these is not to remove the curvature, but to maintain the parts in a state of rest. It is better that the patient should lie on some kind of couch which may be wheeled or moved readily from one room to another, or even into the open air whenever opportunity permits. Nothing tends more than this to the maintenance of the patient's general health: and it is of the greatest importance that the health should be preserved, as a good condition of the constitution promises, I believe, the only chance of the disease being ultimately cured. The recumbent position must be persevered in for a longer or shorter time, according to the state of the disease: it is useless to begin it unless the patient be prepared to persevere until the inflammation in the vertebra has entirely subsided; when that is the case, however, it is quite as necessary that lying on a couch should be gradually given up, and that moderate exercise should be taken to prevent the limbs from falling into a state of atrophy, and the action of the joints from becoming impaired. In some cases, when the inflammation does not spontaneously subside under the influence of rest, antiphlogistic means must be adopted, although the feeling in favour of these is much diminished of late years; either blisters, cupping, moxas, issues, or setons, may be tried, with the object of removing the inflammation, and, as I have just said, in some cases they are necessary; at the same time I place much more reliance upon the effect of rest, if sufficiently well maintained. As the power of nature to repair the parts depends upon constitutional energy, where there is evidence of the disease having its origin in a scrofulous diathesis, alterative remedies, nutritious diet, and sea air are, I believe, the most effective in their operation; the secretions must also be kept in a healthy and proper state. In cases where the disorder seems to have arisen without any particular diathetic cause, especially when there is more pain than usual, Sir Benjamin Brodie recommends the use of bichloride of mercury, followed by sarsaparilla, given in large doses. As soon as there is evidence that the active disease in the bone is entirely subdued, the restoration of muscular power, and the improvement of the physical condition of the spine, as well as that of the health generally, will be greatly accelerated by the judicious use of gymnastics; and no one seems to be more competent to direct the application of these exercises than Mr. Hamon, of Jermyn-street, who has contrived some very ingenious apparatus to direct the exercise to particular muscles of the body, and whose success I can speak of from my own experience in several cases.

LECTURE XXV.

CONTINUATION OF DISEASES OF JOINTS.

Diseases of articular cartilage—Articular cartilage extra-vascular—Its diseases originate either in the extremity of the bone, or in the synovial membrane—Absorption of cartilage—Prolongations of synovial membrane—Anchylosis—Diagnosis of disease in cartilage—Diseases of synovial membrane—Symptoms—Treatment—Cases—Rheumatic inflammation of synovial membrane—Gonorrhœal and chronic inflammation—Injuries to synovial membrane—Cases—Abnormal growths of synovial membrane generally concomitant with a morbid condition of the articular cartilage—Loose cartilages—Mode of removal—Treatment.

DISEASES OF ARTICULAR CARTILAGE.

If the disease in the articular extremity of a bone goes on unchecked, the nutrition of the articular cartilage will become interrupted, as it derives its nourishment in great measure from the bone; the consequence of this will be, that the cartilage will also fall into a state of disease. Indeed, as articular cartilage is extra-vascular, it is supposed that its diseases cannot originate in itself, but either in the articular extremity of the bone, or in the synovial membrane; and the character of the disease will depend upon whether it takes its rise from the former or latter of these tissues. If the synovial membrane be the source of the altered action, the cartilage desquamates, in the same manner as the cuticle separates from the true skin. I do not apply the term ulceration to this action, as the usual appearances of ulceration do not manifest themselves—such, for example, as the presence of vessels conveying red blood: but I believe the redness in such cases proceeds from the bursting of the bulbous extremities of the capillaries, so that the blood is permitted to pass at once into the canals ordinarily receiving only those of its constituents which are necessary to the nutriment of the structure; but it sometimes happens that, under the influence of disease, the capillaries prolong themselves into the canals in the form of distinct bloodvessels.

When the articular extremity of the bone is the original seat of the disease, the cartilage becomes first affected on its osseal surface, and rapidly softens and disintegrates. The surface of the bone becomes more vascular, and the cartilage is more or less separated from it, so that it can easily be removed; sometimes the cartilage is absorbed in patches, at others it gradually becomes thinner and thinner, until at last it wholly disappears, leaving the articular surface of the bone exposed at the points, whence the cartilage is thus removed by ulceration; the vacuity is filled by portions of synovial membrane, which are prolonged inwards, as it were, from the edges or circumference of the cartilage. The membrane thus abnormally present becomes highly vascular, and was regarded by my late colleague Mr. Key as an apparatus for the absorption of the cartilage; I cannot, however, agree with this view of the subject, but am inclined to regard these abnormal growths as produced by a reparative effort on the part of nature, for I find, by experiment, that when a portion of the cartilage is completely removed from the articular surface of a bone, the synovial prolongation occurs exactly as in disease, and, therefore, I cannot consider this extraordinary formation of a tissue to be established for the purpose of absorbing that which has already been taken away.

In the removal of cartilage by ulceration, shallow cavities are most generally produced; these go on increasing in extent until they run into each other; they also increase gradually in depth, removing portion after portion of the cartilage, until the bone is denuded. The ulcerative process then extends to the bone itself, which becomes ulcerated and carious in its turn.

When the articular cartilage is removed from a joint, so that the extremities of the bones come in contact, anchylosis, or growing together of the bones, is the consequence, and the joint becomes perfectly stiff. I have already said, that during the progress of anchylosis, the surgeon should be careful to maintain the limb flexed at such an angle as will best provide for its usefulness when the ossification is complete. But constitutional and local remedies may also be indicated: perfect rest is, however, most requisite; for if the union of the bones of the joint be not complete, the partial mobility which remains, renders the parts continually subject to inflammation, and it may sometimes be necessary to amputate (even after the original disease had subsided), owing to the severe constitutional effects produced by the friction of the parts of the joint in its abnormal condition.

Disease of articular cartilage is generally met with in persons in the earlier periods of life. Sir Benjamin Brodie has remarked that it is often preceded by pains similar to those of rheumatism; hence he believes it to be in some instances the result of rheumatism in the harder textures. The pain, which first shows itself in a diffused character, becomes fixed in one joint, and is so acute, that it often prevents the patient from sleeping. Starting in the sleep, particularly in the first moment of forgetfulness, is a strong symptom of this disease. While awake, the limb is supported in the easiest and most natural position by the action of the voluntary muscles, but the power over these being lost as soon as sleep supervenes, the limb drops, owing to its gravity, and the rubbing together of the inflamed cartilages producing a sharp pain, gives rise to a sudden starting, which is symptomatic of cartilaginous disease. It is difficult to account for the violent pain which forms a prominent feature of disease of articular cartilage. It is supposed that the cartilage contains no nervous fibres; if this be the case, the extreme sensibility of the parts in these cases is a curious phenomenon; it is, however, a question whether the extremities of the bone are not always sufficiently implicated to account for the existence of the pain and involuntary starting in the sleep. If the ulceration of the cartilage be allowed to go on unchecked, suppuration supervenes, and abscess of the joint is established. The symptoms now become more violent, and the joint is swollen from the effusion of pus into its cavity; generally the swelling is irregular in shape, and as the abscess grows bigger, the matter makes its way to the surface in the same manner as in ordinary abscess. The termination of disease of cartilage in abscess takes place but rarely if proper treatment has been adopted in the first instance; sometimes, however, abscess follows upon ulceration, and goes on until the joint is completely destroyed.

When perfect anchylosis does not take place after the cartilage of a joint has been removed, a slight degree of motion may exist, without producing the ill effect I have described; in these cases a change termed eburnation is produced in the articular surface of the bone, a calcareous concretion (containing a large proportion of carbonate of lime) is formed in the place of the cartilage, and the surface of this formation is so exquisitely smooth, as to permit of considerable motion in the joint: this condition is more frequently met with in cases of non-reduced dislocation than in those of imperfect anchylosis.

Diseases of the synovial membrane.—Inflammation may attack synovial membrane by extending to it from some other tissue of the joint, or it may arise in the synovial membrane itself; it occurs chiefly in the middle and later periods of life, being seldom met with either in youth or at the period of puberty: it is technically termed synovitis. It may be the consequence either of external injury, of rheumatism, or of gonorrhœa. The first symptoms of inflammation in the synovial membrane are pain (increased by motion), and swelling, which is produced by an inordinate secretion of synovia. Under these circumstances, rest, leeches, and the usual antiphlogistic means are indicated; the application of these being regulated according to the constitution of the patient, and the severity of the symptoms that are present. If the symptoms subside under the treatment adopted, the disease is said to terminate by resolution; but it sometimes goes on to suppuration, and this I believe often occurs from the remedies not having been sufficiently active to subdue the inflammation in the first instance, but merely converting it into the chronic form. This chronic condition should be most carefully guarded against, as it is more insidious in its effects than the acute stage of the disease, and not less likely to produce permanent mischief.

The influence of different constitutional conditions in respect to synovial inflammation is often very strongly marked; it is probable that a gouty or rheumatic diathesis is a frequent cause of it, and a state of a chronic synovial inflammation is not uncommon in certain stages of secondary syphilis. Inflammation of synovial membranes is much more common than that of the serous membranes; although they very closely resemble each other. This is easily accounted for when we consider the different circumstances under which they are placed, the former being, for instance, subject to constant motion and exposure to external influences, from which the serous membranes generally are completely protected.

Suppuration does not very frequently happen as the effect of simple inflammatory action, but I have known it come on rapidly after acute inflammation of the synovial membrane. Sir Benjamin Brodie mentions a case of a child nine years of age, who, having sprained his hip, was soon after the accident seized with rigors, and died on the seventh day. A post-mortem examination showed the existence of suppuration of the synovial membrane. A patient under my care at Guy's Hospital was the subject of inflammation of the elbow-joint. The symptoms did not give way under the usual antiphlogistic treatment, but on the fifth day he was seized with rigors and violent constitutional irritation; this was, however, subdued by sedative medicines, and amputation performed. In this case also, the joint was found filled with pus.

When the inflammation of a synovial membrane has subsided, the effused fluid is absorbed, but it often happens that although the joint is restored to its natural size and shape it remains stiff; sometimes the enlargement of the joint is permanent, which perhaps arises from lymph being effused into it. Synovial inflammation is not always confined to one joint, two or more are often attacked at the same time, or the disease flies from one joint to another. It is most usual, however, for it to be limited to one joint. Sir Benjamin Brodie has remarked "that in inflammation of the synovial membrane of the hip, if active treatment be not had recourse to in the first instance, there is always danger of the head of the femur being thrust outwards beyond the margin of the acetabulum, and then completely dislocated by the action of the muscles. It is presumed that in such cases the internal ligament of the hip either becomes stretched and attenuated until it at last gives way, or that it is altogether absorbed." When inflammation of a synovial membrane has existed for a long time, a kind of crepitus can be distinguished on moving the joint; this passes away, however, as the inflammation subsides. It perhaps arises from a defect in the secretion of synovia, so that the necessary lubricating medium is not furnished to the joint.

Ulceration of synovial membrane is rarely a primary result of inflammation, unless some constitutional or specific cause be in operation. When inflammation occurs, the whole of the structures of the joint soon become implicated, so that it is difficult to ascertain whether the ulceration of the synovial capsule is the result of primary or secondary action. The remedies indicated in these cases are constitutional rather than local, and their character therefore depends upon the peculiar diathesis of the patient.

Rheumatic inflammation of the synovial membrane is generally produced by lengthened exposure to cold and wet; it may usually be distinguished from ordinary inflammation either by the circumstance of several of the joints becoming simultaneously affected, or by the erratic tendency of the disease, which flies from joint to joint, and produces what is termed metastasis. Under these symptoms, leeches, or, in persons of plethoric habit, even venesection, should immediately be resorted to; a blister should be applied to the inflamed part, and colchicum, combined with a neutral salt, administered. Calomel and opium should also be given at bed-time. If these means fail in subduing the swelling, although the pain may be removed, pressure is indicated, and I usually apply an ointment composed of equal parts of blue-ointment and soap cerate, with a little camphor. Over this, strips of adhesive plaister are laid, in order to maintain the amount of pressure necessary to induce absorption.

Patients suffering from gonorrhœa are subject to the attacks of a peculiar form of synovitis, which so closely resembles the rheumatic affection, that it is sometimes extremely difficult to distinguish between them; indeed, it is only from the history of the case that a just diagnosis can be formed. It usually happens in such cases that the gonorrhœal discharge ceases simultaneously with the accession of disease in the joint. It is of the highest importance that the former should be re-established as quickly as possible, the best means being the application of warm fomentations over the organs of generation. I have never known an attack of the above kind to occur unless the patient had taken copaiva, and am inclined to think that this medicine acts specifically on the synovial membranes; for I have invariably found the symptoms of inflammation greatly aggravated by its administration: indeed, I have known a case in which the administration of copaiva always produced an affection of the joints similar to rheumatism. Bark and alkalies, combined with opium, seem to be the most appropriate remedies: colchicum does not afford relief. In these cases the latter circumstance constitutes a further distinction between gonorrhœal and rheumatic affections.

Chronic inflammation of the synovial membrane.—This form of inflammation is generally attended by ulceration of the articular cartilage, the excavations commencing on its synovial aspect. When the cartilage is absorbed, the chasm is filled up by prolongations of the synovial membrane; but these abnormal growths always proceed from the circumference of the cartilage, tending towards its centre, and do not consist of mere thickenings of the membrane. This has given rise to the idea that the synovial capsule does not extend over the whole surface of the cartilage, but terminates at the edges; as, if it were continued over the whole of the surface, thickening of the membrane at the points of ulceration would seem to be as effective a means of reparation as the extension of the new formation from the edges. If we suppose the synovial membrane to terminate at the edges of the cartilage, it will be difficult to comprehend how the vitality of the latter can depend upon the synovial capillaries, unless we allow that the nutrient matter of the blood is admitted by the edges alone of the structure, which certainly (judging from the condition of the parts under the influence of chronic inflammation) appears to be the case.

Injuries to synovial membrane.—Simple rupture of synovial membrane, as in dislocation, is repaired with surprising rapidity, and the process of restoration appears to depend as much upon the inflammation and thickening excited in the tissues surrounding the seat of the accident, as upon the reparative efforts of the ruptured membrane itself; but when a punctured wound is made in a synovial capsule, the most violent symptoms often occur. The wound may, perhaps, heal readily, without producing more than a slight increase in the secretion of synovial fluid; and if this be absorbed, the case soon terminates favourably. Generally, however, acute inflammation follows an injury of this description; fresh accumulations of synovia take place, the cicatrix gives way, and the superabundant secretion is discharged. Suppurative inflammation is set up, both in the joint and neighbouring structures: violent irritative fever, attended with exacerbations of hectic fever, supervenes, and the patient shortly sinks from utter prostration of strength.

If, however, the injury to the synovial capsule be sufficiently extensive to lay it completely open, or if the nature of the inflammation be such as to destroy its characteristic properties as a secreting membrane, it appears capable of sustaining a considerable amount of injury without interfering with the constitutional powers. The following case will serve to illustrate the foregoing remarks:— A patient of Mr. Ward, of Huntingdon, received, by the accidental discharge of his gun, a severe wound in the right knee. The contents of the gun struck the patella on the outer side, carrying away the whole of that bone, excepting a very small portion which remained attached to the ligament: the joint was completely exposed, but the cartilages of the tibia and femur appeared to be uninjured. The patient would not consent to amputation; and, under the course of treatment adopted, he continued to progress without any unfavourable symptoms, and in less than three months after the accident the wound had healed, and he was able to dress himself, and sit up in a chair; and in the middle of March (the accident having happened in November) he could ride on horseback. A case very much resembling the one just described occurred in Sir Astley Cooper's practice. A dragoon officer at Brighton was thrown from his horse, and completely shattered the patella, laying open the whole of the joint. In this case also the limb was preserved, and the patient shortly recovered.

In the treatment of the various accidents and diseases of joints, it is of great importance that the surgeon should ascertain when the synovial membrane has undergone that organic change which destroys its character as a secreting apparatus. When this change has occurred, the joint may be laid open with comparative impu nity, and the ultimate processes of reparation often facilitated. Under this altered condition of the synovial capsule, excision o portions of the articular surface of a joint may sometimes b effected without any dangerous symptom ensuing; while, if the tissue were in its natural condition, the most violent effects upon the constitution would probably be the result of the operation; and, indeed, the danger of opening a healthy synovial membrane is too frequently proved in the excision of loose cartilages from joints.

The synovial membrane is subject to abnormal growths, the most frequent of which consists in a pulpy formation, first described by Sir Benjamin Brodie, and which is so similar to the prolongations I mentioned when speaking of the cases in which the articular cartilage had become absorbed, that I can only regard it as a reparative effort on the part of nature to check a deteriorating process in the latter structure; for where I have had the opportunity of examining a diseased joint after amputation, I have invariably found these prolongations, or abnormal growths of synovial membrane, to be concomitant with progressive morbid change in the articular cartilage: sometimes small pendulous processes are found in the synovial capsule, and on them is formed a tissue resembling cartilage in every respect. They often grow to a considerable size before they become detached; in the latter state they are termed loose cartilages.

The composition and nature of these bodies is remarkable; when of small size they are found to be cartilaginous throughout, but when larger they consist in the centre of phosphate of lime, which is surrounded and coated externally with cartilage. These formations are not only found in the joints, they occur in connexion with the serous membranes, as the pleura, peritonæum, and pericardium.

While the cartilages remain fixed to the synovial membrane of a joint, they produce little inconvenience; but when detached, they frequently get between the articulatory surfaces, and suddenly prevent motion, causing acute pain, and so much inflammation, that active treatment is required to subdue it.

While this extraneous body remains in the joint, the patient is always liable (under exertion) to suffer from its interference; hence it becomes necessary to resort either to palliative treatment, or to attempt the radical cure of the disease. The most usual, and, perhaps, the safest plan, is to endeavour by careful manipulation to expel the loose cartilage from between the articular surfaces of the joint, and to prevent its return by a knee-cap contrived for the purpose, taking care that the patient does not attempt to walk without this protective appendage. Radical cure can only be effected by an operation for the removal of the loose cartilage by actual excision; this is a somewhat formidable operation, and the patient should be well prepared for it by previous constitutional treatment, so that he may be the less liable to subsequent inflammation.

In performing the operation, the surgeon should press the loose cartilage to the outer side of the joint, between the patella and external condyle; it should be firmly confined to that situation by means of a ring, or the bow of a large key, which, when pressed upon the part, will prevent the loose cartilage from slipping away again into the joint. The skin over the cartilage must be drawn downwards as far as its elasticity will permit, and held in that manner while a firm incision is made through all the tissues down upon the cartilage, which is generally forced out by the tension of the neighbouring parts. The skin previously drawn downwards may now be released, and when it has returned to its natural condition, the incision through it will be no longer in apposition with that in the synovial membrane, and the subsequent escape of synovia, and atmospheric influence on the wound in the synovial capsule, completely prevented. Over the external incision, white of egg, or collodion, may be laid on, and a strip of adhesive plaister above that. A splint should be placed behind the joint, so as to ensure perfect rest; evaporating lotions may also be applied, and constant watch kept for the slightest symptom of inflammation, in order that it may be combated at the first moment of its appearance. In spite of every precaution, however, violent inflammation frequently follows this operation, leading to extensive suppuration in and about the joint; the consequence being, the loss of the limb, or of the life of the patient. In the course of my practice, I have performed the operation for extirpation of loose cartilage three times; in the first, with perfect success, not one untoward circumstance occurring. In the second, violent inflammation followed the operation, and an anchylosed joint was the result. In the third case, suppuration supervened, and the constitution of the patient became so much affected as to render amputation inadmissible; and he sunk from hectic fever, after protracted suffering.

Another method of operating for the removal of loose cartilage has been proposed within the last few years, and I consider it much safer than the old plan. A narrow-pointed bistoury is inserted into the skin at some distance from the loose cartilage, and pressed onwards until it reaches the point at which it is situated. The cutting side of the knife is then turned towards the joint, and the synovial membrane divided sufficiently to admit of the loose cartilage being forced out into the subcutaneous cellular tissue, where it is allowed to remain until the wound in the joint is healed; it may then be removed by a mere incision through the skin. The same treatment must be resorted to in this as in the other operation, and similar means must be employed to subdue inflammation, if it should have already commenced.

LECTURE XXVI.

CONTINUATION OF DISEASES OF JOINTS.

Bursæ mucosæ—Their situation, formation—"Housemaids' knee"—Treatment—Danger of laying open or applying seton—Inflammation of ganglia—Suppuration—Treatment—May be mistaken for exostoses, or chronic abscess, fatty tumour, or malignant disease—Case—Bunion—Ganglion on the back of the foot.

Diseases of ligament—Atrophy—Inflammation—Diagnosis of primary inflammation—Sprain—Treatment—Difficulty in curing sprain in patients of rheumatic diathesis—External injury the most frequent cause of disease in the joints—Diseases of diarthroses illustrated by those of the hip-joint—Symptoms—Treatment—Sawing off the head and neck of the femur—Formation of supplementary joint.

DISEASES OF THE BURSÆ MUCOSÆ.

Bursæ mucosæ exist in three different situations in the body, viz.—between the periosteum and the skin, the periosteum and the muscles or their tendons, and between the tendons themselves. These are their natural localities; but supernumerary bursæ are frequently formed in different parts, in consequence of inordinate pressure: thus, in distorted spine, a bursa will sometimes be formed between the skin and the projecting bones; it appears, indeed, to be provided by nature to prevent the inflammation that would otherwise be produced by the continued pressure upon the soft parts. Pressure on a natural bursa mucosa will, however, cause inflammation in that body, and even lead to its obliteration, so that an action similar to that which within certain limits will produce a supernumerary bursa, will, when carried to an inordinate degree, destroy those already formed by nature.

Supernumerary bursæ are usually termed ganglia, and are generally formed either on the patella, the back of the wrist, or on the palmar surface of the articulation of the phalanges with the metacarpal bones.

Although these formations are not themselves of a dangerous character, they sometimes interfere so materially with the action of the muscles, the tendons of which are affected, as to render surgical treatment necessary in most cases in which they occur.

Inflammation of bursæ is indicated by nearly the same symptoms as inflammation of the synovial membranes of a joint. It is generally attended by an increased flow of synovia, and, if the inflammation continues, by a thickening of the membrane, which sometimes becomes cartilaginous in its character. This is not, however, always the consequence of prolonged inflammatory action, for the sac of a bursa will sometimes remain inflamed without thickening for a very long period. The inflammation of bursæ is generally of a chronic kind. An inflamed bursa appears under the form of a painful tumour, more or less developed according to circumstances. As it contains fluid, it sometimes happens that fluctuation can be distinguished, but this depends upon the situation of the tumour, and the depth at which it is placed; when superficial, the fluctuation is often very distinct. There is a very curious circumstance connected with bursæ—viz. that when the inflammation has continued for a considerable time, it is not uncommon to find in the synovia they contain small loose bodies of a flattened oval form, resembling melon seeds; these are supposed to originate in coagulation of the lymph contained within the sac.

Inflammation of natural bursæ is most frequent in the bursa of the patella, in which constant pressure induces a diseased condition of the knee known by the name of "housemaids' knee;" and in the poplitæal space it is also not unusual to meet with a tumour of the same kind formed by the inflammation of the bursa of the tendon of one of the flexor muscles. This is sometimes met with as a complication of inflammation of the bursa of the patella. The tumour formed by inflammation of a bursa is generally very easily diagnosed from any other swelling; for instance, the tumour which I have just mentioned as occurring in the patella can scarcely be mistaken for any other. It is not always, however, that the tumour can be distinguished by its containing a fluid, even when placed thus near to the surface, as after a time the parietes of the sac become so much thickened that it possesses the character of a solid mass. If acute inflammation be concomitant with this affection, evaporating lotions, leeches, purgatives, and rest, must be the curative means adopted; as soon as the inflammation is subdued, a blister should be applied: one is seldom, however, sufficient to produce the desired effect, and even three or four may be requisite to produce absorption of the superabundant synovial secretion. It is also advisable to apply moderate pressure, which will have the effect of promoting to a considerable degree the absorbent action established by the blisters. Some authors have recommended that the bursæ be laid open; others, that a seton should be passed through them; I consider both of these means dangerous, not to say unjustifiable, at any rate until a milder plan of treatment has been tried, and found insufficient to the purpose. It is true, that, from long-continued pressure upon ganglia, the synovial capsule becomes so completely altered in character, as to be no longer capable of secreting synovia, and an effusion of plasma occurs, which becomes organized, and (for the same reasons as those that regulate the treatment of synovial membrane of a joint under like circumstances) may be excised without danger; in such a case the tumour may be laid open, or a seton passed with impunity, because the synovial capsule no longer exists under the form of a closed secreting sac.

Inflammation of bursæ, as well as that in other structures, sometimes terminates in abscess; when this is the case the latter may tend to the surface of the skin, and then burst; at other times the pus is discharged subcutaneously, escaping into the cellular tissue by which the abscess is surrounded; inflammation of the bursa of the patella is very liable to go on to suppuration, in this manner. A large abscess on the knee, taking its rise from the middle of the patella, is not by any means uncommon; the matter spreads all around as from a centre, raising up the skin, and forming a sort of cushion, as it were, over the whole extent of the bone. The pus may be evacuated from a suppurated bursa, as in a common abscess, excepting that the opening should be larger, and the healing of the orifice prevented, in order that the further formation of matter be stopped, and the membrane of the ganglion stimulated to granulate, that the cavity may be filled up.

Ganglia on the back of the hand are frequently cured by a sharp blow given by the back of a book or other convenient instrument. In this case the sac is burst by the force of the blow, and the synovial fluid which it contains diffused into the surrounding tissue; the sac is, however, often so dense as to resist any moderate force. I therefore think it a better plan to pass a couching needle beneath the skin, introducing it at some distance from the ganglion, and, after puncturing the sac in several places, to squeeze the synovial fluid into the cellular tissue: pressure must afterwards be applied to the part, and a splint then adjusted, to insure perfect quiescence of the wrist-joint.

In all operations upon bursæ, great caution is necessary to avoid subsequent inflammation, which may not only be the cause of pain and inconvenience in itself, but may end in suppuration, which may produce extensive mischief in a joint, and even the death of the patient. When the bursæ are very superficial and independent of the tendons, the danger in operation is much diminished; but under all circumstances, trifling as it may appear, it is one requiring caution and judgment on the part of the surgeon.

The smaller description of ganglia which sometimes occur on the palmar surface of the hand, at the extremity of the metacarpal bone, cannot be subjected to such treatment as that just detailed; but they must be punctured, and the small quantity of synovia they contain expressed from the opening.

In some situations in the body it is extremely difficult to form a diagnosis of bursæ mucosæ: they are sometimes so hard as to be mistaken for small exostoses: and by the enlargement of the bursa, between the latissimus dorsi muscle and the inferior angle of the scapula, a tumour may be formed, which might be readily mistaken for chronic abscess, steatoma, or even malignant disease; a surgeon conversant with the character of ganglia in their natural state would soon, however, discover the real cause of the swelling.

I have seen a case of tumour in the upper part of the thigh (opposite the trochanter minor) which presented great difficulty in its diagnosis; it had been mistaken for irreducible hernia; and, from a degree of pulsation which it derived from a neighbouring artery, it was also believed to be aneurism; but the regularity of the bowels, and the peculiar character of the pulsatory motion, led me to suspect the nature of the swelling; and, by the application of blisters, the pressure of a truss, and continued rest, its dispersion was ultimately effected.

On the feet, and more particularly on the inner side of the root of the great toe, an adventitious bursa, commonly termed a bunion, is very frequently formed; it may be produced by tight and ill-made shoes, which force the great toe into an unnatural position, out of the line of the axis of its metatarsal bone, and under the other toes, in such a manner that the bone of the first phalanx presses forcibly on the capsular ligament of the joint, and induces the inflammation and acute pain attendant upon this distortion. Unless the deformity be remedied, the continued pressure of the bone increases the inflammatory action, and ulceration would be the ultimate result, were it not for the compensating provision of nature, which leads to the formation of a ganglion between the capsular ligament and the skin. If, however, the pressure be still continued, it may induce inflammation of the newly-formed bursa, and an inflamed bunion is the consequence; this so completely cripples the sufferer, and the pain is so excessive, that the assistance of the surgeon is here usually sought. Although various mechanical contrivances have been proposed, and many different kinds of plaisters, the object of all being to remove the pressure which has been the original cause of the disease, no treatment can prove successful unless the great toe be restored to its natural position, parallel with the others; the most simple and effectual means of doing this, is the one adopted by my late colleague Mr. Key: he recommended that the stocking of the patient should be furnished with a division or compartment, resembling the finger of a glove, to receive the affected toe, a similar compartment being also constructed in the inside of the shoe: into these the toe passes, and is preserved in a direction parallel to that of the others: but it may be necessary, before resorting to the use of this contrivance, to subdue the local inflammation by the application of leeches, blisters, or evaporating lotions.

A ganglion on the dorsum of the foot or instep, sometimes produces even a more serious form of disease than the bunion. It may cause contraction of the extensor tendons of the small toes, permanently extending the latter, so that the whole of the weight of the body falls during progression upon the first phalanges, in which situation ganglia are found precisely similar to that just described as occurring at the point of the great toe. If these become indurated by neglect or continued pressure, so that the effused contents cannot be let out by puncture, the only alternative left is to divide the implicated tendon or tendons, so as to relieve the permanent extension of the phalanges, and restore the toes to their natural position. I have known exfoliations of the phalanx occur from this affection, but immediately upon the removal of the exfoliating bone, the deep ulcer in the sole of the foot healed.

Diseases of ligament.—When ligament is divided, it possesses within itself a natural power of reparation, which soon produces the re-union of the parts, although the matter by which the continuity is restored remains for some time in a different physical condition to that of the original structure. The newly formed ligament is elastic, and it does not lose this property until it has been some time subjected to tension, which seems to be the stimulus required by nature to produce in new structures the peculiar condition necessary to the performance of their functions.

From a long diseased action, ligament becomes deteriorated, and falls into a state of atrophy; it then becomes elastic, and incapable of limiting the motion of the joints to the degree required in their normal condition, and it is not until the whole joint has been for some time exposed to the effect of exercise that its healthy state is restored.

The ligaments are not very subject to idiopathic inflammation, excepting as the result of the specific action of rheumatism, gout, or syphilis. If either of these be the cause of the disorder, the synovial membrane is generally first affected, and therefore the treatment I have already described when speaking of synovial membrane is applicable in cases of disease of the ligamentous tissue.

If the inflammation of the ligament be primary, it may generally be diagnosed by the slight degree of swelling which occurs at the joint, and by the absence of acute pain while the patient is standing on the diseased limb in the erect posture. The least motion is, however, productive of severe suffering, and this constitutes an important distinction between disease of ligament, and that of synovial membrane or cartilage; as in the latter case, the most painful position is when standing upright, with the weight of the body pressing on the affected articulation.

The most frequent cause of inflammation of ligament is what is termed "sprain," an injury which arises from forcible twisting or contortion of the joint, to a degree exceeding that permitted by the natural flexibility of its ligament. Considerable pain is a constant concomitant of sprain, and the ill effects of the accident are often of long duration, and extremely difficult to remove. This, however, is, I believe, the effect, in great measure, of the slighting manner in which such an injury is usually viewed by the surgeon, who appears to be satisfied as soon as he ascertains that neither fracture nor dislocation has occurred, and consequently does not resort to remedies sufficiently active to overcome at once the inflammatory action, which is allowed to proceed until it assumes the chronic form. In the treatment of sprain, leeches, fomentations, or evaporating lotions, should be employed, the choice between these depending upon the constitution and temperament of the patient. In some cases warm, in others cold applications, are most advantageous: the sensation produced upon the patient generally indicates the best mode of procedure; but in order to avoid the liability to produce the reaction, which occasions so much discomfort, tepid applications are, I think, generally preferable. In addition to the other topical remedies, a splint must be adjusted to maintain perfect rest in the injured joint, and when the inflammation has entirely subsided, "passive motion" must be resorted to, in order that the structures may be gradually restored to their natural functions.

In patients of a rheumatic or gouty diathesis, there is generally considerable difficulty in curing a sprain, as in such persons the ligaments sometimes undergo so great a degree of softening as never to recover their natural condition; the joint consequently remaining in a permanently impaired state.

In examining a diseased articulation, it is often difficult to form a diagnosis as to which of the tissues, or whether more than one, is the subject of the inflammation, and also as to the character of the change produced in the different tissues by the same attack of inflammation.

Considering the structures of a joint collectively, it may be said to be liable to ordinary inflammation, which may terminate in adhesion, suppuration, or ulceration; it is also subject to the influence of specific diseases, such as scrofula, gout, or rheumatism.

External injury is one of the most frequent of the exciting causes of disease in the joints; it is characterized by swelling, pain, and intolerance to motion. Antiphlogistic remedies must here be had recourse to; likewise leeches, fomentations, and perfect rest. Every means must indeed be employed to completely subdue the inflammation, so as not merely to convert an acute into a chronic form of the disease.

If the increased vascular action and its effects in the joint depend wholly upon a local cause, the antiphlogistic system of treatment, combined with rest, will generally be found sufficient to overcome the disease; but if the inflammation be idiopathic, or even if it arise from external injury in the case of a person of strumous or malignant diathesis, it may assume a more dangerous character, and appropriate constitutional remedies must be employed in addition to the local applications already recommended.

We sometimes find an injury, which at first appeared to be of trifling importance, sufficient to excite the development of some specific constitutional tendency or action, which may render fruitless all attempts at reparation, and lead to the necessity for amputation of the limb, and not unfrequently cause the ultimate destruction of the life of the patient. In the course of practice I have known several cases, in which an apparently slight external injury to a joint, in a scrofulous diathesis, was productive of the most disastrous consequences. And so, also, it happens in a gouty or rheumatic diathesis, that a trifling sprain will induce a specific action, which, occurring in a broken-down constitution, often leads to the total loss of the natural powers of the affected joint.

The following case affords a good example of the serious effects sometimes produced in a joint by comparatively slight causes operating under the influence of a strumous diathesis.

George Scott, æt. 18, of scrofulous habit and highly irritable temperament, was admitted into Guy's Hospital with a chronic affection of the left knee-joint. He stated, that four years previously, he had fallen, and severely sprained his knee, so that for some days he was totally unable to use it; but, by degrees, it appeared to be completely restored to its natural state, and he suffered no inconvenience for several months; when, without any apparent cause, it again became painful and much swollen, and he was obliged to lie by and obtain medical advice. The treatment adopted relieved him for the time, and he was soon able to walk a short distance; but the slightest jerk gave him increased pain, and he was sometimes obliged to keep his bed for several days together. His constitution soon became affected, and when admitted to the hospital the joint was swollen and very painful: there was a projection on either side of the patella, which appeared to be the result of effusion of albumen and consequent thickening. In moving the joint (over which he possessed no voluntary power), there was considerable stiffness, and a slight grating sensation was experienced. There was also acute pain, heat, and redness. Leeches and evaporating lotions were applied, and tonics with small alterative doses of mercury, administered. His health, however, became worse, and amputation was finally determined on. The boy seemed to derive immediate benefit from the removal of the source of irritation; his health rapidly improved, and he was soon discharged quite recovered.

On examination of the knee-joint, the synovial membrane was found very much thickened and vascular, particularly round the condyles of the femur and the posterior part of the patella: there was also ulceration, and the articular cartilage was softened, spongy, and partially absorbed, and the ligaments were soft and altered in their structure. Notwithstanding the disease in the joint there was no suppuration, which is indeed less frequent than is generally supposed.

As the whole of the tissues I have described as entering into the composition of joints are comprehended in the diarthroses, and as the diseases of a joint are necessarily referable to the deterioration of those tissues, I select as an example the affections of the hip, which will, I think, suffice to give a general idea of the nature of joint disease.

Disease of the hip joint.—The peculiarity of this disease is the insidious manner in which the patient is attacked; and a remarkable feature is, that almost one of the first symptoms which attracts the attention of the patient, is a pain on the inner side of the knee, leading the cursory observer to apply remedies to this part, although it, in point of fact, suffers only sympathetically.

The disease generally takes its rise in the cancellated structure of the bones, in the cells of which a fluid is deposited, and the bone contains a less proportion of phosphate of lime than usual.

The affection soon extends from the bone to the cartilage, in which, as I remarked in a former lecture, vessels conveying red blood may be traced. The cartilage seems also to be separated from the bone, so that it may be removed without much difficulty. Ulceration of the cartilage is soon set up, generally beginning in patches on its osseal surface, the bone also becomes carious, and an abscess in the joint is established.

When children are attacked with this complaint, the parents first discover that the child limps in its walk, without having previously complained of any pain; or, perhaps, in undressing the child, they may have noticed that the lateral gluteal regions are not symmetrical. Upon questioning the child, it now, for the first time, complains of a pain upon the inner side of the knee; the parents immediately attribute these circumstances to some local cause, and the nursery-maid is almost invariably blamed for having concealed some accident, which they feel convinced must have induced the local injury. But as soon as the child walks into the room, or, perhaps, when put down from the arms, a surgeon of any experience at once understands the nature of the affection: the limb is thrown forwards, the pelvis upon the same side is depressed, so as to give the appearance of a lengthening of the limb; and upon closer examination, the affected limb will be found much diminished in size. The patient is unable to bear any weight, excepting on the sound leg, and consequently, cannot stand quite erect; pain is experienced on striking the trochanter major in such a direction as tends to force the head of the bone into the acetabulum, and also from pressure in the inguinal region immediately on the outer side of the femoral artery. The nates on the side of the diseased hip is, in the early stages, much more prominent than natural, but ultimately becomes diminished and flattened, so that flattening, at one period, forms a diagnostic mark of the disease. The sympathetic pain is not invariably felt in the knee-joint, but is frequently referred to the inner side of the thigh, sometimes producing involuntary twitchings of the muscles.

The first object of the surgeon, when called to such cases, should be to discover the exciting cause of the complaint, whether it be local, constitutional, or of a specific action. If the inflammation has been induced by external injury, cupping or leeches, with blisters, and rest for some short time, will usually subdue it. It may, however, be a more severe injury, as on some violent exertion the ligamentum teres may have been injured. Should such have been the case, a greater length of time, and more active depleting means, would be required to subdue this greater source of injury. When the disease is idiopathic, it becomes much more difficult to treat, and the prognosis is less favourable; the constitution becomes early affected, swelling occurs in the neighbourhood of the joint, and twitchings of the limb, particularly during sleep, disturb the rest of the patient, who is totally incapable of bearing the slightest weight upon the limb. If the swelling increases, and the pain becomes aggravated, more especially during the night, attended with rigors, nocturnal exacerbations of fever, quick pulse, hot skin, and a furred tongue, the surgeon is led to the conviction of matter having formed, and an opening should be made as soon as fluctuation denotes its having escaped from the interior of the joint. From the slowness of the progress, from the degree of constitutional irritation, from the length of time matter continues to flow after the abscess has been opened, and from the unhealthy kind of pus which is secreted, (frequently offensive and discoloured,) I am induced to believe, that the disease of the hip which terminates in abscess, most frequently begins in the bones of the articulation, and that the cartilages are not primarily affected, as has been stated by some writers. In young people, the disease most frequently first affects the bones of the pelvis, the acetabulum becoming diseased before the femur; indeed, it not very unfrequently happens, that the abscess bursts into the cavity of the pelvis. When the cartilage is primarily affected, which I believe to be but of rare occurrence, the symptoms are less urgent, and the patient is capable of performing the common avocations of life during the progress of its removal by absorption. In this disease, although articular cartilage is never reproduced, a peculiar deposition termed an eburnation is formed, which will enable the joint to perform a considerable degree of motion without consequent inflammation.

In an advanced stage of disease of the hip-joint, the pain becomes much more acute, particularly if the patient has been using the limb during the progress of the disorder. The pain is also much aggravated as soon as suppuration has commenced. When the matter ultimately makes its way out of the joint into the surrounding tissues, forming an external abscess, the pain is generally mitigated, but it is still impossible to move the limb without causing acute pain, in consequence of the absorption of the articular cartilage leaving the inflamed extremities of the bone in contact.

It is rare that the hip-joint is the subject of disease from external injury; it much more frequently arises from scrofulous affections, generally terminating either in permanent lameness from anchylosis, or death from the debilitating effects of extensive abscess.

Patients that are brought into public hospitals with hip disease, will almost invariably derive great benefit from the generous diet with which they are provided; but if the children of the affluent be affected with hip disease, being already accustomed to the continued influence of nutritious diet, that great source of restoration is lost to them, and the prognosis, under these circumstances, is much less favourable in private than in public practice. By continued ulceration in the bone forming the acetabulum, and in the head of the femur itself, they may become disintegrated and destroyed; or the cavity of the acetabulum may become filled with effused lymph or pus. The sequel of a continued disease of the hip-joint is therefore not unfrequently spontaneous dislocation, and when this occurs, the head of the femur is invariably drawn upwards by the action of muscles. Under these circumstances, all the structures entering into the composition of the joint are altered, if not destroyed by the disease; the acetabulum first becomes affected, the cartilage is loosened from the cotyloid cavity, and ultimately ulcerates; the fibro-cartilage next becomes implicated in the disease, the ligamentum teres ulcerates, the head of the femur undergoes a similar change, and the glutei muscles draw it upwards upon the dorsum of the ilium; all these morbid changes frequently go on without the patient experiencing any great pain while in a state of rest, until abscesses form, when pain, constitutional irritation, and hectic fever, indicate the commencement of suppuration.

The principles which regulate the treatment of scrofulous disease of the joints are very simple, although the application of those principles, that is, the immediate treatment, is subject to great diversities of opinion.

This is a disease which arises entirely, I imagine, from a defective state of the constitution, and therefore it may be said that whatever system of treatment tends to improve the constitutional powers is good, and, on the other hand, everything which tends to lower and diminish those powers, bad: counter-irritation from blisters, setons, issues, &c., seems to be productive in most cases of little benefit; indeed, any continued drain upon a constitution already vitiated cannot, I think, fail to do mischief. Good air, that of the sea-coast if possible, nourishing diet, a careful regulation of the secretions, by small alterative doses of mercury or some other medicine, are the chief indications; tonics may likewise be used: quinine, cinchona, gentian, and the mineral acids, may all be advantageously given according to circumstances; and it is said that the preparations of iron, if continued for a considerable time, exercise a marked beneficial influence. Cod-liver oil is another remedy which latterly has come much into use, and, it is said, with great advantage in diseases of this kind; but the great desideratum is the application of such means as are best adapted to keep the joint in a perfect state of rest, for the irritation resulting from motion would at once render abortive the beneficial action of any constitutional remedies. In disease of the hip-joint, therefore, the first indication is to confine the patient to the recumbent posture, as perfect rest is as essential here as in diseases of the vertebræ: attention should be paid to the position in which the patient lies on the couch or bed, for if the inflammation should continue and the joint become anchylosed, much of the future usefulness of the limb will depend upon the position in which it is fixed. To prevent motion of the joint, a splint may be placed upon the pelvis and thigh, and this not only very effectually keeps the limb immoveable, but at the same time affords a support which gives great comfort to the patient. The length of time during which rest and confinement are necessary must of course vary according to circumstances: when the disease is much advanced, a very considerable time—some years—may be necessary before anchylosis is complete; but when the disease is in an early stage, a few months may suffice for the cure, as the inflammation may be subdued without anchylosis taking place.

After the spontaneous dislocation of the femur upon the dorsum of the ilium, and the patient has recovered from the effects of the disease in the structures of the joint, he still remains subject to the inconvenience of a useless limb; for the neck of the thigh-bone, and the flat surface of the os innominatum, upon which it rests, are so ill adapted to each other as scarcely to permit of the slightest motion between them. When, therefore, the constitution of the patient is restored, and the local inflammation completely subdued, surgical means may be resorted to; the head and neck of the femur may be sawed off, and as the trochanter major from its form can adjust itself to the surface of the bone it rests upon, a very effective supplementary joint will be established, and the condition of the patient much ameliorated.

This operation has been successfully performed by Mr. Fergusson, among others, and is neither difficult nor dangerous if the period for its performance be judiciously chosen.

LECTURE XXVII.

DISLOCATIONS.

Definition—Liability of different kinds of joints to Dislocation—Causes: predisposing, immediate—Enarthroses, may be displaced in any direction—Ginglymoid and trochoidal limited—Reduction not always to be attempted—Diagnosis—sometimes difficult from swelling—Prognosis—General treatment—Preparation of the patient—Application of mechanical force—After-treatment—Case.

Dislocation of the lower jaw—Causes—Diagnosis—State of muscles—Mode of reduction—Partial dislocation—Treatment—Liability to recurrence.

Dislocation of the clavicle—Dislocation from the sternum—Direction—Cause—Diagnosis—Treatment—Case—Dislocation of scapular extremity of the clavicle—Diagnosis—Prognosis—Treatment.

Dislocations. — Having completed the account of the diseases of joints, I shall proceed to the consideration of the condition technically termed dislocation. By a dislocation is meant the displacement of the articulatory surfaces, which, when in their natural contiguity, form a joint. The treatment in dislocation depends upon the kind of joint which has suffered the injury. In the synarthroses and amphiarthroses, the surgeon's attention must be given to the organs contained within the bony cavities, rather than to the employment of means for restoring the coaptation of the joint. In depression of the bones of the head, for instance, no mechanical means must be used, unless compression of the brain be the result of the accident, when the part must be trephined exactly as in case of fracture: so also in dislocations of the spine, the symptoms closely resemble those arising from fracture, and the treatment is similar in every respect. In speaking, therefore, of dislocation, it is the displacement of the diarthrodial articulations that will chiefly demand attention.

Before I enter upon a description of the abnormal signs of dislocations, I must strongly point out the extreme necessity for an accurate acquaintance with the normal character of the various joints; so that the surgeon may be able to recognise immediately any deviation from their natural form.

The diarthroses are more liable to dislocation than any other kind of joint; this arises from their greater extent of motion. There are three kinds of diarthrodial joints—the enarthrosis, or ball and socket; the ginglymoid, or hinge; and the trochoidal, or wheel-like joint: of all these, the ball and socket, owing to the great extent and variety of their movements, are the most liable to luxation.

The causes of dislocation are *predisposing*, or *immediate*. The former may be produced by the operation of any influence which tends to relax the ligaments, without altering the vital power of the muscles; as in the disease termed hydrops articuli, for example, where the synovial fluid has been suddenly absorbed, leaving the ligaments in a state of relaxation from the continued pressure from within, and consequently not in a fit state to offer the resistance requisite to restrain the motions of the bones: under such circumstances displacement may very readily occur. In scrofula, also, the ligaments frequently become so elastic, as not only to be incapable of preserving the joint against external force, but to be also unable to withstand the ordinary contractile power of the muscles. European children born in very hot climates appear to have a predisposition to displacement of the joints from slight causes; this probably arises from a certain constitutional tendency to elasticity of the ligaments. The immediate cause of dislocation may be a fall, or other external violence; but to admit of luxation, the displaced bone must be in such a position at the moment of the accident, that some of its muscles are so relaxed as to be incapable of protecting the joint; for when either the upper or lower extremity is in such a position that the muscles can be prepared to resist the force, it is almost impossible for dislocation to occur. Some of the joints can only undergo displacement when the force is applied in a particular direction—as, for instance, the articulation of the radius with the ulna, which can only suffer dislocation through inordinate supination or pronation of the fore-arm.

When summoned to a case of dislocation, there are numerous preliminary considerations which must engage the attention of the surgeon before he proceeds to the treatment of the injury. The first of them relates to the classification of the injured joint, as to whether it belongs to the ball and socket, ginglymoid, or trochoidal class. Knowledge on this point will not only facilitate the diagnosis, but likewise the prognosis, and choice of treatment. If, for example, the injury be inflicted on a ball-and-socket joint, the surgeon would be aware that the head of the displaced bone may be driven from its natural situation towards any point of the circumference of the circle that can be described by the limb; the direction depending upon that of the force by which the accident was caused: in the hinge and trochoidal joints, on the contrary, he would know that from their naturally limited degree of motion, the displacement, unless the injury were complicated with fracture, could only take place in two directions.

It is very important, in a dislocation, to ascertain the direction in which the head of the bone has been displaced, as from this knowledge the nature of the dislocation can be inferred, and the best means adopted to effect its reduction.

The length of time that may have elapsed after the accident, bears a most important relation to the mode of treatment. After a certain period has passed, it would be imprudent to attempt reduction, for the head of the bone shortly undergoes a change to adapt it to its new situation, which unfits it for restoration to its normal one; and at the same time the cavity whence it was thrown experiences deterioration from the deprivation of its function: this is another circumstance which renders an attempt to restore coaptation extremely improper, after a certain time, and unlikely to be attended by a satisfactory result. Time alone does not, however, effect these changes; they depend as well upon the degree of motion to which the joint has been exposed in its abnormal state. If it has been preserved in a state of perfect rest, the changes in the articulatory surfaces will be but slight; but if continued efforts have been made to render it useful, it soon acquires so complete an adaptation to its altered circumstances, that it is converted into a much more useful joint than it would be likely to become under the restoration to its natural coaptation.

In all cases of dislocation it is necessary to take into consideration the conditions concomitant with the accident, for by these the surgeon will be either led to determine upon attempting to preserve the limb, or to decide promptly upon amputation, as affording the only chance of saving the life of his patient. The points that would assist the judgment are, however, so similar to those spoken of under "concomitants with fracture," that I refrain from again entering into the details of the subject.

Diagnosis of dislocation.—The change of form in the joint, so far as refers to the relative position of the processes of bone, affords the best means of ascertaining the existence of dislocation. It is true that similar appearances may be produced by fracture near a joint; but the facility with which the displaced parts can be restored in fracture, and the great force required to produce a like effect in dislocation, constitute an important distinctive mark between the two kinds of injury. There is another point of difference:

when a dislocation is reduced, there is generally no difficulty in preserving coaptation; whereas, in fracture, that is frequently the most serious difficulty with which the surgeon has to contend. A shortening or elongation of the limb invariably accompanies dislocation; and the immobility of the displaced bone is also highly characteristic of the accident. In dislocation of a joint of the extremities, the whole of the injured limb cannot be brought in a line with the axis of the trunk, and as the dislocated bone must be elevated or depressed from its natural position, the muscles proper to the joint are either stretched or relaxed, which produces an unnatural change in its general contour. The distinctness of all these marks depends, however, upon the time that has expired after the occurrence of the injury; for, as I have already mentioned, the parts have a great tendency to accommodate themselves to their new position, and they consequently quickly assume a more natural appearance. In dislocation, depressions are frequently present where prominences ought to exist, and *vice versâ*. Such appearances plainly indicate an abnormal condition; in fracture they may be easily removed, but in dislocation only by a force sufficient to reduce the luxation. In the combination of all these signs it would be impossible, in any case of dislocation, to mistake the nature of the accident; but the violence necessary to effect the displacement of the bones, generally inflicts considerable injury on the soft parts, and produces so much contusion and consequent swelling, as to conceal in a great measure the characteristic abnormal configuration. The diagnosis then becomes difficult, and it might happen that one surgeon, if called in soon after the accident had occurred, may overlook the true nature of this kind of injury; while another, who happened to be consulted after the swelling had subsided, would readily detect it. I believe, however, that a dislocation will rarely escape discovery, if a strict scientific examination of the injured part be made.

Prognosis in dislocation is formed from a careful estimation of all the preliminary considerations I have described: firstly, with regard to the kind of diarthrodial joint dislocated,—the prognosis being less favourable in case of injury to the ginglymoid than in that to the enarthrodial class; for, owing to the comparatively complicated structure of the articulatory surfaces of the former, a greater degree of force is required to effect displacement, and the amount of injury to the soft parts is proportionably extensive. Even among the ginglymoid joints the prognosis varies, according to the comparative strength of their ligaments; and dislocation of the knee and ankle are much more dangerous in character than that of the wrist-joint. Secondly, the direction in which the head of the bone is thrown, and the extent to which it is removed from its natural situation, constitute important points in the prognosis of dislocation. The bone may, for example, be thrown in such a position as to press upon large bloodvessels, or nerves. Under these circumstances unfavourable symptoms are likely to accrue, in proportion to the injury the structures have sustained. Thirdly, as to the length of time that may have elapsed after the occurrence of the accident; but, in that case, the prognosis refers rather to the restoration of the joint than to the probability of any danger arising to the life of the patient. The circumstances under which the surgeon would attempt the restoration, or, on the other hand, leave the supplementary joint undisturbed, have been already discussed. In forming a prognosis in dislocation, however, the attention must be particularly directed to the concomitant circumstances of the accident, as those affect not only the question of the ultimate reparation of the joint, but also the degree of danger with which the life of the individual is threatened; and it is according to the severity of these concurrent conditions that the surgeon is guided in his judgment as to the advisability of resorting to amputation, or endeavouring to restore the joint to its normal state.

General treatment of dislocation.—The indications in dislocation are in many respects similar to those of fracture, viz., the coaptation of the displaced surfaces, and, in order to effect that object, the application of extending and counter-extending forces. In fracture, as I have mentioned before, the coaptation is readily effected, but in dislocation it is very difficult to restore the displaced articulatory surfaces to their natural places, and the adaptation of the mechanical means competent to effect this, constitutes the chief difficulty attendant upon the whole operation. When once the dislocated bone is adjusted in its natural situation, very simple means only are necessary to maintain it there; it being merely requisite that the injured limb should be brought in the direction of the axis of the body, and confined by bandages. When the injury has happened to the upper extremity, the bandages may be passed around the chest, including the limb; and when the lower extremity has been the seat of injury the limb may be confined to the sound one. In the ginglymoid joints the luxated articulation is to be placed and maintained in such a position that the whole of its muscles are in a state of relaxation: hence semiflexion is the position to be observed. It is usual for the surgeon to resort to constitutional treatment to promote the effectual operation of his mechanical applications; if, for instance, the patient be powerful and athletic, it would be advisable to diminish the force of the muscular contractions, and bleeding, warm bath, and tartarized antimony, are generally used for this purpose. If bleeding be chosen, it should be performed so as to produce the strongest effect upon the patient by the abstraction of the least possible quantity of blood sufficient for the purpose: he should be placed in a sitting or standing posture, and a large opening made in the vein in order to ensure a rapid flow of blood; when faintness is induced it should be kept up for some time by administering small doses of tartarized antimony, a solution of that salt being previously so prepared that the exact quantity contained in each dose of fluid may be known: at the same time care must be taken not to excite vomiting, as the reaction in that case will completely annul all your previous efforts. The patient being reduced to a fit state for the application of the apparatus, the next object is to adapt the counter-extending or resisting force, the intention of which is to prevent the receiving bone of the joint from yielding under the influence of the extension, which is made by means of pulleys upon the more moveable —in fact, upon the dislocated bone. The direction in which the extension is to be applied is at first always that which the dislocated limb has assumed in its abnormal condition, the force being exerted from the distal extremity of the bone, so that additional power may be acquired by the length of leverage obtained. Some surgeons recommend that the extending force should be applied even at the extremity of the affected limb; but although increase of power is thus gained, there is danger of injury to the structures of the intervening joints; and where the pulleys are employed, I believe it imprudent to apply the force at any point having a joint between it and the point of resistance. In the dislocation of the humerus, however —which may almost always be reduced by the strength of a man, without any mechanical assistance,—the counter-extension may be effected by placing the heel on the displaced head of the bone where it is felt in the axilla, and by a steady pull with the whole force, from the wrist, the strength may be exerted with confidence, for that of a single man is incapable of injuring the tissues of the intervening joints. There is great advantage in employing personal, in the place of mechanical power, in these cases, as the operator—being sensible of the effect he is producing—can modify the power he exerts according to circumstances; whereas that of the pulleys is invariable in its amount, and always exerted in the same direction. The use of pulleys appears to be confined to the English and American surgeons; in France, it is said that they are never employed.

In dislocation of the hip, particularly when the subject possesses great muscular power, the pulleys must necessarily be employed, as greater steadiness and uniformity of action can be obtained by their means than from the united efforts of several individuals, who can seldom be made to act regularly and simultaneously; indeed, the pulleys are also preferable when considerable force is required, as the extension should be gradual, and not applied by jerks. Most writers on dislocation have stated that the evidence of restored coaptation is a loud snap, produced by the sudden return of the head of the bone into its natural cavity. Those who expect to witness such an effect in cases where the pulleys are employed, will, I think, be disappointed; and if the extension were continued until it was heard, the limits of the operation would be extremely indefinite. Such a snap could only be produced by the contraction of the muscles, and how is it possible that this action can occur when the whole of them are so powerfully extended? One of the greatest difficulties attendant upon the reduction of luxation (more particularly of the hip-joint), is really to ascertain when the bone is replaced; for, as the patient is laid in a posture in which the extremities cannot be compared, the only guide to the judgment is the examination of the relative position of the trochanter major with the anterior and superior spinous process of the ilium. It is true, the question may at once be decided by relaxing the extending power, and examining the joint, to ascertain whether motion be restored, and the two limbs rendered symmetrical. The great disadvantage of this is however, that if the reduction should not have been effected, the muscles of the patient will in some degree recover their tone during the time the extending force is removed, and the whole process have to be recommenced. It is therefore highly important, that the precise comparative conditions of the injured and healthy joints should be well understood by the surgeon, that he may know when coaptation is restored, without removing the apparatus or relaxing its extending force.

The treatment, after reduction of the dislocation has been effected, depends upon the degree of force which it was found necessary to exert in restoring the natural condition of the joint, and also upon the peculiarities of the constitution of the patient: it is therefore impossible to lay down any precise rules, but the appropriate remedies will be indicated by the peculiar symptoms that manifest themselves.

I have never known but one instance of death which could be attributed to the force applied for the reduction of a dislocation; and in that case the patient's constitution was highly irritable; and, after the operation, violent inflammation of the hip-joint supervened, abscesses formed, and he sunk under hectic fever.

I have intended the preceding remarks to apply generally to dislocation, and to be introductory to the account of dislocations of the joints individually. In pursuance of the subject, I shall now go on to describe the luxations of each particular joint, and shall commence with

Dislocations of the Lower Jaw.—This bone can only suffer displacement in one direction,—its articulatory processes being thrown forwards from the glenoid cavity of the temporal bone. It will readily be understood why this should be the case; for, although the lower jaw is capable of depression, protention, and lateral motion, it is only in depression that the extent of motion is sufficient to permit of the displacement of its articulatory surfaces. The accident is most likely to occur during the act of yawning, when the jaw is much depressed; in this state, owing to the leverage presented from its construction and position, a slight blow on the symphysis is sufficient to produce luxation. The condyles are then thrown out of their articular cavities under the zygomatic arches, and the jaw is permanently fixed in a state of depression.

The diagnostic marks in such a case cannot be mistaken: the mouth is wide open, the saliva pours from it, and no force less than that sufficient to reduce the dislocation is capable of closing it. The temporal and masseter muscles are forcibly stretched, and it is against their contractile power we have to contend in replacing the bone. The pterygoid muscles are relaxed, owing to their points of origin and insertion being brought nearer to each other; they do not, therefore, offer any resistance to the reduction. Constitutional treatment is seldom required in these cases as preliminary to the application of mechanical force. The inconvenience arising from the accident is so marked in character, that the patient is sure to apply at once for surgical assistance; and the judicious application of moderate force will generally be found sufficient to restore the part to its natural condition. The best mode of reducing the dislocation is, to place the patient on a low chair, and, standing immediately in front of him, apply a thumb to the last molar tooth on either side of the jaw, supporting the symphysis at the same time by the middle and fore-finger of each hand. Forcible pressure, sufficient to overcome the contractile power of the temporal and masseter muscles, is then made by the thumbs upon the molar teeth; the condyles of the jaw are thus depressed to a level with the glenoid cavities whence they were displaced; the moment this is effected, the thumbs must be quickly removed from the teeth, and slipped between the cheeks and the gums; at the same time the symphysis is suddenly raised by the fingers, and the condyles are forcibly drawn into their places by the action of the muscles. The patient's capability to bring the upper and lower teeth in just apposition is a sufficient proof of the reduction of the dislocation. It sometimes happens that the necessary depression of the condyles cannot be accomplished by the hands, as I have described; pieces of wood, or the handles of forks, may then be inserted between the upper and lower jaw on either side, and, being employed as levers, the jaw may be sufficiently forced down to admit of its replacement.

Partial dislocation of the lower jaw sometimes occurs, and generally results from a blow on one side during its forcible depression. The diagnosis is as clear here as in the complete luxation; but the effect produced is different, the contortion corresponding so completely with the lateral displacement as to render the nature of the accident at once obvious.

The only after-treatment in dislocations of the jaw consists in keeping the teeth in juxtaposition by means of a bandage, which must be worn for a longer or shorter period, according to the degree of injury the surrounding soft parts may have sustained. At any rate, it is proper that the patient should, for some days, take only such nourishment as will not require mastication.

In dislocation of the lower jaw, the interarticular cartilage is always displaced with the condyloid process of the bone.

Persons who have once suffered from this accident, and in whom precautionary measures had not been observed during the progress of reparation, are very liable to its recurrence from the slightest cause; and I had a patient under my care who never dared to yawn without supporting the jaw, for fear of producing its luxation.

Dislocations of the Clavicle.—From the comparative thinness of the clavicle, from the slight protection it derives from soft parts, and from its frequent exposure to external violence, from the peculiar manner in which it is placed between the shoulder and the sternum, it much more frequently happens that the clavicle is fractured, than that its articulatory surfaces are dislocated, either from the scapula or sternum. Another circumstance which renders the dislocation of this bone rare, is the slight degree of mobility which it possesses in its articulations, and that only depending upon the motions of the scapula; so that the sterno-clavicular articulation might, I think, be properly classed as an amphiarthrodial joint, being partly obedient to the application of a force, communicated from the whole of the upper extremity, and partly only under the influence of appropriate voluntary muscles. Thus, by the action of the trapezius and sterno-cleido-mastoideus muscles, we can voluntarily raise the clavicle to a slight degree; but under the various motions of the scapula, no power of volition can prevent the former from being reciprocally influenced. Hence it is, that dislocations occur so seldom to the clavicle, in proportion to its degree of mobility; for, although not provided with that support which the muscles of the diarthrodial articulations afford them, it is rendered peculiarly strong by the number and size of its ligaments, and is under all circumstances equally capable of sustaining the same amount of force, without its articulatory surfaces being displaced. Diarthrodial articulations, on the contrary, are most liable to luxation, when force is applied to them at a moment when the muscles are not prepared, by the consciousness of the person receiving the blow, or when, owing to the limb being in the semiflexed position, they are incapable of giving strength and support to the articulation. It may be said, that great strength is afforded to the moveable joints by the vital influence of the muscles; while the amphiarthrodial and synarthrodial joints derive their security principally from the physical properties of their ligaments: the former, being liable to dislocation when the muscles, either from unconsciousness, or position, are unable to employ their power of defence; while the two latter are, under all circumstances, almost equally capable of resisting injury. Dislocations of the clavicle are divided into, dislocation from the sternum, and dislocation from the acromion process of the scapula. I shall describe these different dislocations.

Dislocation of the clavicle from the sternum.—The clavicle may may be thrown in three directions from the sternum,—upwards, forwards, and backwards: dislocation upwards is produced by the forcible depression of the scapula,—that forwards, by the scapula being carried in a contrary direction,—while its displacement backwards is produced by the inordinate forcing of the scapula forwards. The dislocation forwards is the most frequent, in consequence of the inclination the clavicle takes at its connexion with the scapula, as well as from the more extensive motion of the scapula itself, in the backward direction, tending to force the sternal extremity of the clavicle through the anterior sterno-clavicular ligament.

The usual exciting cause of the above accident is the application of force to the shoulder, when the arm is carried backwards to its fullest extent, and the articular surface is forcibly driven through the anterior ligament upon the fore and upper part of the sternum; this is more likely to happen when the head is bent forwards, as the sterno-cleido-mastoideus muscle in that position offers less protection to the articulation. The diagnosis is very easy, in consequence of the dislocated or displaced bone forming a projecting circumscribed tumour, admitting of the particular form of the articular surface being felt through the skin, which is nearly all that covers it. The upper extremity having lost its fulcrum, the shoulder falls towards the chest, and the patient is no longer capable of raising his arm to his head. I have seen several such cases, and in all, the diagnostic marks readily led to the explanation of the injury, which could only be mistaken for fracture of the clavicle, and then only by a cursory observer; as the absence of the projecting sternal extremity of the fractured bone, and the impossibility of removing the deformity by raising the elbow, which can so readily be accomplished in fracture, render the distinction obvious.

The treatment is also the same in these cases as in fracture of the clavicle, consisting in the application of a large cushion in the axilla, so as to form a fulcrum, and confining the elbow close to the side; the scapula, and clavicle with it, are carried outwards, so as to enable the surgeon by the application of a compress, composed of a piece of cork surrounded by lint, to press the sternal extremity of the latter backwards into its situation. Thus, the coaptation may be readily effected, but, contrary to the general rule laid down with respect to dislocations, the difficulty in these cases is to maintain it; and not all the attention of the surgeon can prevent some slight degree of permanent prominence on the affected side. An apparatus has been recommended, somewhat similar to a tourniquet, for the purpose of applying a force immediately upon the projecting bone, but whatever be the means adopted, it is necessary to employ them for a considerable length of time, to permit of the reparation of the different structures of the articulation.

If from external violence the scapula be driven forwards, so as to impel the sternal extremity of the clavicle against the posterior sterno-clavicular ligament, with a force which it is incapable of resisting, and which is at the same time sufficient to tear through the costo-clavicular ligament, the articular surface of the bone is driven behind the upper extremity of the sternum; the width of the shoulder must be immediately lost, the motions of the upper extremity impaired, a deep depression instead of prominence marks the position of the sterno-clavicular articulation, and superadded to these symptoms, the functions of respiration and deglutition are sometimes affected by the pressure of the head of the bone against the trachea and œsophagus. The strength, however, of the ligaments, and the slight extent of motion which the scapula enjoys in a direction forward, almost precludes the possibility of such an accident occurring from external violence. Sir Astley Cooper, however, mentions at p. 370, in the fifth edition of his *Treatise on Dislocations and Fractures,* a case of this kind, which was produced by the gradual pressure of the clavicle inwards, arising from a distorted spine: the progressive distortion occasioned so much projection of the clavicle inwards, as to occasion extreme difficulty of deglutition; and as every means excepting removal of a portion of the displaced bone were considered hopeless, Mr. Davie, the surgeon under whose care the patient was placed, performed the following operation. An incision was made of from two to three inches in extent on the sternal extremity of the clavicle, in a line with the axis of the bone and its ligamentous connexions; this being divided, he sawed through the clavicle one inch from its sternal extremity, having introduced a piece of stout leather behind the bone, while he divided it with Hey's saw. The chief difficulty which occurred in the operation was in the division of the interclavicular ligament, which he was obliged to tear through, using the handle of his knife as an elevator, when he was enabled to remove the detached portion of bone. The patient lived for six years after the operation, and recovered from the emaciation which had been produced by the dysphagia. The result of this case proves the propriety of removing the pressure from the œsophagus, but whether the operation which was performed was the best to effect this object, I must beg leave to question. Would not the same happy result have followed, by removing a portion of the centre of the clavicle, which would have equally prevented pressure on the sternal extremity of the bone, and consequently on the œsophagus, without leading to all the dangers which must have presented themselves in dipping down behind the sternum?—a situation, perhaps, of all others, the most formidable for a surgical operation.

It is said that the sternal extremity of the clavicle is liable to dislocation from the tearing through of the interclavicular ligament. The kind of force which I should consider most likely to produce this accident, is that resulting from an attempt to raise weights, suspended in a manner similar to that in which pails are carried; the weight being beyond that which the strength of the person would enable him to raise, a yielding of the capsular and interclavicular ligaments of the sterno-clavicular articulation may be produced.

I have never seen this accident, and am led to believe, upon consideration, that it can hardly take place; for, although this dislocation might be primarily produced by such a cause as I have mentioned, I cannot understand how the displaced clavicle can remain in a situation above the sternum, as it would be drawn downwards upon that bone by the action of the pectoralis major muscle.

Dislocation of the scapular extremity of the clavicle.—I have seen this accident much more frequently than the displacement of the sternal extremity of the bone; but taking an anatomical and physiological view of the two articulations, it would be difficult to say which joint ought to be considered most liable to luxation: the simultaneous motion of the acromial extremity of the clavicle with the scapula, the slight degree of mobility of this articulation, the strength of its own ligaments, aided also by the coraco-clavicular ligaments, give at once the appearance of an equal protection against injury to this articulation, as in the case of the sternal. To prove that there is a great difficulty in estimating the comparative liability of the two joints to dislocation, Sir Astley Cooper commences the section appropriated to this subject, thus, "This accident is more frequent than the dislocation of the sternal extremity;" while Boyer has it, "These luxations are less frequent than the former," alluding to the sterno-clavicular articulation. As I have before said, I consider the acromial extremity more subject to displacement than the sternal.

The form of the articulatory surfaces of the portions of bone entering into the formation of the acromio-clavicular articulation, is such as to lead to the displacement of the clavicle upwards on the acromion, the direction in which the acromial articular face tends. The displacement is usually produced by a fall from a height upon the point of the shoulder; this drives the scapula downwards and inwards towards the ribs, while, at the same time, the violent involuntary inspiration induced by the sensation of falling, draws the clavicle upwards, producing a sliding of the two oblique articulatory surfaces of the joint upon each other, which permits of their separation, the trapezoid and the conoid ligaments being at the same time torn through, as well as the superior and inferior ligaments of the acromio-clavicular articulation.

The existence of this dislocation is easily ascertained, not only from the superficial situation of the displaced portion of bone, but also from the impaired motion of the extremity, and intolerance of any attempt to move the limb, as it calls into action the deltoid and trapezius muscles, and which, by causing a degree of motion in the displaced bone, produces considerable pain. In speaking of the action of the trapezius muscle tending to the displacement of the clavicle from the acromion, it may be asked by the student, if the attachment of the deltoid would not counteract the influence of the trapezius? The answer is, that the contraction of the trapezius occurs through the stimulus communicated to it by its respiratory nerves, a function in which the deltoid performs no part; and it is to be remembered, that it is not merely the attachment of a muscle which comprehends all the science of its use, but the different sources through which it gains its nervous influence is a subject of the greatest importance. In the many cases of the dislocation of the clavicle at the scapular extremity which I have seen, they have all occurred in the direction upwards, and have each exhibited the diagnostic marks indicating the nature of the accident. It is generally very difficult to produce coaptation, and still more difficult to maintain it, in this accident. The mode of producing coaptation is similar to that described in the dislocations of the sterno-clavicular extremity, and in fractures of the clavicle, that is, by placing a cushion in the axilla; but upon bringing the elbow to the side, in these cases, great difficulty occurs in carrying the scapula outwards from the clavicle, probably in consequence of the manner in which the trapezius and deltoid muscles connect the two bones with each other: this difficulty is proportionate to the length of time which may have elapsed after the accident had occurred. When by continued attempts the articulatory surfaces of the bone are brought into apposition, a fresh difficulty arises in inventing means to prevent the recurrence of their displacement. The prognosis, therefore, is to be considered as very unfavourable, particularly when we contemplate the apparent unimportance of this accident; and the patient generally leaves the care of the surgeon dissatisfied, from the impaired motion of the affected limb. I have found, however, that although the deformity remains but little altered by time, still the patient regains a considerable degree of motatory power, and ultimately suffers little or no inconvenience. This change must take place, I suppose, from the formation of a new arthrodial articulation, although I have never had an opportunity of examining such a case after death.

I have not seen the clavicle thrown under the acromial process of the scapula, neither do our best authors upon the subject describe it as having occurred in their practice; it would therefore be useless to dwell upon its indications.

LECTURE XXVIII.

DISLOCATION OF THE UPPER EXTREMITY.

Dislocation of the humerus, may take place in three directions—Into the axilla—Backwards or inwards—And backwards and outwards—Diagnostic marks—Cases.

Treatment—Partial dislocation forwards generally the effect of disease—Dislocation of elbow-joint—Dislocation of ulna and radius backwards—Causes—Diagnosis—Treatment—Dislocation of ulna backwards—Partial dislocation outwards—Mode of reduction—Partial dislocation inwards—Dislocation of radius from ulna of the superior radio-ulnar articulation—Dislocation of the radius forwards—Cause—Symptoms—Treatment—Dislocation of radius backwards—Dislocation of inferior radio-ulnar articulation—Dislocation of the wrist-joint—Of the carpus backwards—Carpus forwards—Lateral dislocations of the carpus—Dislocation of the carpus and metacarpus—Of the phalanges—Diagnosis and treatment.

Dislocations of the Os Humeri.—It is generally considered that the humerus is more frequently dislocated than any other bone in the body. Boyer asserts, indeed, that "the frequency of luxation of this bone equals in number that of all the other bones collectively." The liability to this accident is attributable, in the humerus, not only to the extent but also to the variety of its motions.

In examining the form of the glenoid cavity, and the articulatory surface of the head of the humerus, in the dry bones, the student would be puzzled to know how, in a state of motion, they were to be kept in apposition; and even in the progress of his anatomical studies, when examining the ligaments of this joint, he will still think the capsular ligament, and the fibro-cartilaginous rim of the glenoid cavity, but ill calculated to prevent the displacement of the articulatory surfaces of the two bones from each other: but when studying the muscular system, particularly that of the shoulder-joint, he will find that they not only arise from one of these bones to be inserted into the other, but that their tendons and fibres are frequently inserted into the capsular ligament, and through the medium of it; or sometimes by actually passing through, become more imperceptibly lost in the fibro-cartilaginous rim of the glenoid cavity, so, in fact, as to strengthen if not to form the ligamentous part of this structure. Thus we find, that the muscles of this joint are not only destined to move bone upon bone, and to vary the direction of these motions, but also, at the same time, to fix all the structures of the joint. It is from the circumstance of this joint deriving much of its strength from its muscles, which can indeed only materially strengthen it while they are in action, that its dislocations occur from such slight causes.

The humerus may be dislocated in three different directions—namely, downwards into the axilla; downwards, forwards, and inwards, upon the venter of the scapula; and backwards and outwards upon the dorsum. The second of these dislocations is described by Sir Astley Cooper as a luxation forwards upon the pectoral muscle, when the head of the bone is placed below the middle of the clavicle, and on the sternal side of the coracoid process of the scapula. For my own part, I have never seen a dislocation of this kind, where the head of the bone was thrown upon the inner side of the coracoid process of the scapula, and upon the digitations of the serratus magnus muscle; yet the diagnostic marks of the dislocation I intend to describe accord completely with the account given by Sir Astley Cooper of the dissection of an unreduced dislocation of this sort, in which "the head of the bone was thrown on the neck and part of the venter of the scapula, near the edge of the glenoid cavity, and immediately under the notch of the superior costa, nothing intervening between the head of the humerus and scapula, as the subscapularis was partly raised from its attachment to the venter." Those cases which I have seen have been more difficult of detection than dislocation into the axilla; the head of the bone being more deeply seated, and imbedded in soft parts.

Of the three kinds of dislocation to which the humerus is liable, that downwards into the axilla is the most common, that backwards and inwards next, and the dislocation backwards and outwards upon the dorsum of the scapula most rare. There is a fourth luxation spoken of by Sir Astley Cooper, termed a partial dislocation, in which the articular surface of the humerus glides upon the inner edge of the glenoid cavity, and rests upon the base of the coracoid process of the scapula. In such cases, I believe the capsular ligament is not torn through, and that the partial displacement depends upon the relaxation of the muscles and ligaments, from some constitutional cause.

Dislocation into the axilla.—One of the most frequent causes of this accident is a fall sidewise, with the arm widely separated from the body; the elbow coming in contact with the ground, the head of the humerus is driven against the inferior part of the capsular ligament, and meeting with resistance in that direction from the subscapularis, it is driven inwards with sufficient force to tear through the capsular ligament, between the triceps and subscapularis muscles. The patient immediately loses the power of moving the shoulder, more particularly that of circumduction, as the *point d'appui* to the head of the humerus is lost. Upon examination, it is found that the affected arm is longer than the sound one, and does not maintain its vertical direction, being permanently fixed in an oblique position, so that the elbow is widely separated from the side, to which it cannot be brought; and in tracing the humerus upwards it leads into the axilla, and not into the glenoid cavity of the scapula. On examining the two shoulders, to ascertain whether they are symmetrical, that on the affected side will be found so perceptibly flattened, that this forms a very strong diagnostic feature in the case; while the acromion process projects, so as to mark the empty glenoid cavity immediately below it, into which the finger may be readily pressed.

On tracing the outer side of the humerus upwards from the elbow towards the shoulder, the bone on the healthy side offers the same resistance along its whole extent; but on the dislocated side the upper part of the humerus no longer offers any support, and the fingers sink, from the yielding of the soft parts to the pressure. There may be more or less pain concomitant with this accident, according to the extent of the displacement, and the direction of the bone. When all these signs present themselves there can be no possibility of mistaking the nature of the injury; and, indeed, if from the stoutness of the individual, the flatness of the shoulder and the direction of the bone be not decidedly conspicuous, still, the loss of motion, the permanent separation of the elbow from the side, and the lengthening of the limb, following as the immediate effects of external violence, must be quite sufficient to enable the surgeon to form a just diagnosis. Some have stated that the head of the displaced bone may be felt in the axilla: this can only be in very thin people, and is productive of very great pain; and as it leads to no useful object, I hold it unnecessary to seek for this additional proof of dislocation. In dislocation of the humerus, the first consideration should be, the time since the occurrence of the displacement, the prognosis being favourable in proportion to the early period at which the surgeon is consulted. If the patient be a strong muscular man, and it is determined to attempt the reduction of the dislocation, chloroform should be administered, or blood drawn from the arm through a free opening, the patient being desired, while in the erect position, to fix his eye upon some object on the ceiling; syncope is thus readily produced; and as it approaches, the patient should be extended along the floor, when the surgeon, sitting by the side of the affected limb, places the heel in the axilla, and taking hold of the wrist, performs simultaneously extension and counter-extension by his own muscular power, and the force being steadily kept up for a few minutes, the head of the bone usually snaps into its place. Should the muscular power of the surgeon prove insufficient to overcome that of the patient, a jack-towel may be fastened around the patient's wrist, so that the extending power may be multiplied by the force of one or more persons, the heel of the operator still remaining in the axilla. Sir Astley Cooper recommends that the extending force should be applied to the humerus, by which means he is enabled to flex the fore-arm, and consequently relax the biceps muscle, which he considers offers the resistance to the reduction of the dislocated bone. Anatomy and physiology appear equally to substantiate this opinion; but in my practice I have not succeeded so well by this plan, as by making extension from the wrist-joint. It sometimes happens, however, from the great muscular strength of the patient, and from the length of time during which the luxation has existed, that it may be necessary to employ the pulleys in this dislocation, as well as in that of the hip; they may be adjusted in the following manner:—Having first bled the patient, and used those constitutional means which have already been described as necessary to overcome muscular action, he should be laid in the recumbent posture upon a table of convenient height, placed between two staples screwed into the wall; to one of these is to be fastened the extremity of the apparatus which is employed for fixing the scapula; and this is best done by putting the arm through a hole in the centre of a long round towel, while the opposite extremity of the loop is to be fastened to one staple; or by means of a padded leathern strap, having a hole in it to admit the arm. The fore-arm of the affected limb is then to be bent to a right angle with the upper; when, above the elbow-joint, a girth is to be buckled around the arm, and furnished with a strap on either side, with a ring fixed to each, for the purpose of being attached to one of the pulleys, the other pulley being fixed to the opposite staple. This apparatus should be so firmly fixed and adjusted, that by no chance it may be rendered necessary to release the muscles from the influence of the extension, until the dislocation is reduced.

When the apparatus is thus applied, the surgeon should commence extension by the pulleys, and continue gradually drawing them tighter and tighter, until the muscles are well put upon the stretch; this degree of extension should be continued for five or six minutes, when again further extension may be made; and thus, step by step, force applied until the muscles have sufficiently yielded to remove the dislocated bone from its new situation. Should the surgeon himself not possess sufficient strength to overcome the muscular action of his patient, he should obtain assistance, taking care that this additional force be employed in the same gradual manner. The extension should be made in the direction of the long axis of the displaced bone, when first applied; but as soon as the surgeon perceives that the dislocated bone is removed from its abnormal situation, he should give the pulleys to the care of an assistant, while he himself directs the head of the bone into the glenoid cavity, to perform which it is generally necessary to change the direction of the extending force. When the reduction is effected, the arm should be confined to the side, and placed in a short sling, so as to permit of the reparation of the soft parts of the articulation.

Dislocation of the humerus, backwards and inwards, upon the venter of the scapula.—In this dislocation, the head of the humerus is thrown beneath the coracoid process of the scapula, between the subscapularis muscle, and the venter of the bone; and, under common circumstances, the shortening of the limb is so slight as to be scarcely appreciable; the chief diagnostic mark is, the wide separation of the elbow from the side, and the oblique direction of the whole of the affected extremity outwards and backwards. If this dislocation remain for a few days unreduced, a considerable degree of shortening occurs, by the action of the pectoralis major muscle, which draws the head of the bone upwards, towards the notch of the scapula, and immediately below the clavicle; here, in thin persons, the head of the bone may be felt, covered by the pectoralis major, pectoralis minor, and subscapularis muscles, and not resting, as some have described, between the subscapularis and pectoralis major. The degree of immobility of the limb in this dislocation is another strong diagnostic mark, and the only motion which can be produced is backwards, in which direction the head of the bone meets with no other resistance than that from muscle.

The means of reducing this dislocation is similar to that employed for the reduction of the luxation into the axilla, excepting that the extension is to be made first more outwards and downwards, until the head of the bone has cleared the coracoid process, when the surgeon placing his heel on the head of the humerus, forces it outwards and backwards, while he brings the whole of the upper extremity forwards; the force required is usually greater than in dislocation into the axilla, especially if the accident has occurred long before the attempt at reduction is made. The prognosis in these cases may altogether be considered as less favourable than in the former dislocation, in consequence of the great degree of violence necessary to produce displacement backwards and inwards.

I have frequently seen cases of dislocation of the humerus, in which there was some difficulty in determining whether the head of the bone was thrown downwards into the axilla, or backwards and inwards upon the venter; and I believe, in such cases, that the head of the bone is placed midway between these two directions, upon the anterior edge of the inferior costa of the scapula, between the teres and the subscapularis muscles. I have seen a preparation of an unreduced dislocation of this kind, in which a very efficient artificial glenoid cavity was formed, and the person must have enjoyed some motion of the limb, of course inferior to the natural extent; this was further indicated by the slight diminution of the muscles, but I had no opportunity of acquiring any knowledge of the state of the individual before his death.

Dislocations of the humerus, backwards and outwards, upon the dorsum of the scapula.—Boyer, in speaking of this accident, says, "there is no well attested instance of dislocation of the humerus outwards and backwards;" and he goes so far as to attempt to show why it should not occur, because, he observes, "the tendon of the long head of the triceps opposes it." Notwithstanding, however, this authority, there are numerous instances of its occurrence, and I have seen several cases. The diagnostic marks of this injury are, the loss of motion of the limb, the direction of the arm forwards and inwards, with a slight degree of pronation: the natural roundness of the shoulder may be said rather to be altered than lost, as the flattening occurs only anterior to the acromion, where the skin is drawn into puckers or folds. On raising the arm to a right angle with the side, and tracing the long axis of the humerus, the eye is carried in a direction behind the glenoid cavity; and if the patient be thin, the head of the bone may be felt upon the dorsum of the scapula, on the fossa infra-spinata, between the bone, the teres minor, and the infra-spinatus muscles. But if the patient be stout, or the tumefaction resulting from the injury considerable, the diagnosis is often difficult, especially in consequence of the degree of motion which the humerus retains in this accident; at least, so I found it in the first case I ever witnessed.

Mr. G., a gentleman from Surrey, a very stout man, in the act of violently pushing a person from him, injured his right shoulder-joint; he was obliged to consult a surgeon, who did not discover the nature of the accident, but recommended him to apply leeches, and all the means usually employed for the restoration of a contused joint. As the use of the limb continued impaired, so much so that he could not raise his arm to his head, he came to town to consult Sir Astley Cooper, who not being at home, I was applied to. Upon examination, I found so much tumefaction, that I could not discover the nature of the injury, and desired him to call the next morning. Sir Astley, who was at home, was raising the arm for the purpose of examination, nearly perpendicular to the body, when the head of the bone slipped forwards into the glenoid cavity; thus the nature of the accident was made obvious only by the reduction of the dislocation.

In a few days after, it happened that a gentleman consulted Sir Astley Cooper as a morning patient, who had had a similar accident, and in whom the diagnostic marks were particularly clear; I wrote down at the moment the principal features of the case.

The arm was directed inwards towards the side, giving it the appearance of being fractured. The roundness of the shoulder had lost its natural appearance, and the skin was gathered into folds in front of the acromion process, which was preternaturally prominent. On taking a posterior view of the shoulder, it was impossible to trace the spine of the scapula, in consequence of a fulness below and behind the acromion; and upon raising the arm, the tumour in the fossa infra-spinata moved obedient to the motions of the humerus, indicating the situation of the head of the bone; in tracing the long axis of which, the eye was directed behind the glenoid cavity of the scapula. We tried to reduce the dislocation by slight extension, drawing the arm outwards, but failing in this, Sir Astley raised the limb perpendicularly, at the same time forcing it backwards, behind the patient's head; the bone immediately slipped into its place, being thus reduced precisely in a similar manner to the last mentioned case. It was singular that two instances of so rare an accident should occur so closely together in the practice of one individual.

I have subsequently found that the mode of reduction recommended by Sir A. Cooper is not so generally effective in these cases as the usual method by extension and counter-extension; and I have had this opinion verified by the corroborative experience of others.

Partial dislocation forwards.—I have no experience of this accident, and believe it is more frequently the effect of disease of the joint, or constitutional derangement, than of external injury.

Sir Astley Cooper, however, had a case of this kind: in pointing out the diagnostic features of the accident, he states that the head of the bone projected forwards and inwards against the coracoid process, but on its scapular side, while in the complete dislocation forwards it is thrown to its sternal side, which may form the principal diagnostic mark between the two injuries. In the partial dislocation the capsular ligament is not torn through, and the difficulty which occurs is less in reducing the dislocation than in maintaining coaptation. The reduction of such a displacement is effected by drawing the shoulders backwards, and by using some means to maintain them in that position.

When at St. Thomas's Hospital, I remember that Mr. Patey had an opportunity of dissecting a joint, in which a new glenoid cavity was formed, partly from the coracoid process of the scapula, and partly from the inner edge of the original cavity.

Dislocations of the elbow-joint.—There is no joint in the body which, under accident, requires more anatomical and physiological knowledge than the elbow, particularly in dislocation, when the force required to separate the bones must necessarily be so violent as to produce extensive tumefaction of the soft parts, and conceal the relative position of the natural eminences of the joint, which alone can lead to a correct judgment of the injury. Swelling, pain, and loss of motion, are not the signs by which the true nature of the accident can be comprehended; but the fixedness of the joint, and the change of position of the condyles of the humerus with the olecranon process of the ulna, are the best indications of the displacement of the articulatory surfaces of the elbow-joint. Notwithstanding, however, the peculiar form of the bones which enter into this articulation, the strength of the muscles, and the number of its ligaments, the articulatory surfaces are sometimes the subject of displacement; and the luxations of the elbow-joint may be classed under three different heads:—First, the radius and the ulna may be thrown behind the humerus; secondly, the ulna may be alone thrown backwards; and, thirdly, they may both be dislocated laterally.

Dislocations of ulna and radius backwards.—This accident most frequently occurs in falling from a height, or being thrown from a carriage or horse; the hand being thrust forward to protect the body, when it comes in contact with the ground, the weight of the body has a tendency to drive the humerus forwards, while the resistance of the ground propels the radius and the ulna upwards and backwards behind the condyles of the humerus. The diagnostic marks of this accident are plain in proportion to the degree of separation of the articulatory surfaces of the bones. A permanent state of semiflexion must always accompany this accident, and the attempt to extend the limb produces a considerable degree of pain; in fact, the fixed state of the joint is the great characteristic of this as of all other dislocations: besides, there is found a considerable hollow on each side of the olecranon, and anteriorly a hard projection is found in the natural situation of the hollow of the elbow-joint, formed by the condyles of the humerus. On further examination of this accident, and of the relative position of the olecranon with the condyles of the humerus, we shall find the former elevated far above both condyles, although naturally it is placed on a plane with the external condyle. It is said that "this luxation may be mistaken for fracture of the olecranon, of the head of the radius, or even of the inferior extremity of the humerus;" but the facility of restoring the bones to their natural position in fracture, and the difficulty of doing so in dislocations, distinguish the two accidents. In this luxation, the ligaments are torn through, and the muscles so readily managed, from the perfect command the surgeon can obtain over the joint, that, in general, no great force is required to replace the separated articulatory surfaces, particularly if the attempt be made soon after the accident has occurred; and should there be, from any cause, a mistake as to the nature of the accident, it is not so irreparable as described by Boyer, who says, "that if the reduction be not effected before the end of fifteen or twenty days, it is impossible to accomplish it afterwards." I have seen Sir Astley Cooper reduce this dislocation three months after the accident, and have, myself, succeeded two months after the infliction of the injury, by bending the joint over the knee, and making extension both from the wrist and upper arm, while the knee is pressing the ulna and radius backwards.

When coaptation has been effected, which is indicated by the capability of the joint to perform its natural motions, and the restoration of the olecranon process of the ulna and the condyles of the humerus to their natural relative positions, the arm should be permanently confined to the semiflexed state, with the hand between pronation and supination, by splints adjusted so as to prevent motion, and thus it should be retained for ten days or a fortnight, when all inflammatory symptoms usually disappear, and passive motion may be commenced.

Dislocation of the ulna backwards.—It sometimes, but very rarely, happens that the ulna is thrown backwards from the internal condyle without a corresponding displacement of the radius. The diagnostic marks of this accident are somewhat similar to those of the dislocation of both bones backwards, as far as relates to the projection of the olecranon, and the fixed state of the joint; but in addition to these symptoms, there is a peculiar direction of the fore-arm and hand inwards, in consequence of the resistance which the radius offers to the longitudinal derangement of the limb. It is difficult to imagine how such an accident can take place, and in what direction the force could be applied to produce it; it must either be inflicted upon the ulna or upon the humerus, as no fall upon the hand can lead to it. The reduction of this dislocation is described as being easier than when both bones are luxated; this would naturally be inferred, when we consider that the radius being still attached to the external condyle of the humerus, forms a most convenient fulcrum during the extension of the fore-arm, by forcibly producing which, at the same time pressing the olecranon upon a firm and fixed point (as a hard table), coaptation may be readily produced.

Another circumstance may, perhaps, in some measure, tend to facilitate the restoration of the ulna to its natural position, namely, the tearing through of the coronary and oblique ligaments, which would otherwise serve to fix the ulna, and prevent its easy separation from the posterior surface of the humerus. In cases of this kind which have not been reduced, the radius seems capable of accommodating itself to the new position of the ulna, and by its pressure upon the external condyle produces a new articulatory surface, which enables it to perform some slight degree of flexion and extension, with a considerable power of rotatory motion. I should suppose, as the radius in this accident is so completely separated from the ulna by the lesion of the coronary ligament, that after the reduction of the ulna the radius would be very liable to be thrown either forwards or backwards upon it, in any attempt at pronation or supination of the hand. Hence the propriety, after this accident, of maintaining the elbow-joint at rest for the longest possible period without endangering anchylosis, so that the ligaments may have time to be fully repaired.

Lateral dislocation of the elbow.—The ulna and radius may be partially displaced laterally from the condyles of the humerus; but complete dislocation in this direction can scarcely occur, in consequence of the great extent of surface in contact, without being accompanied by severe laceration of the soft parts, rendering the dislocation compound. Partial displacement may, however, occur both outwards and inwards.

Partial dislocation outwards.—A blow upon the inner side of the upper extremity of the ulna, when the elbow-joint is semi-flexed, may displace that bone from the internal, and force it upon the external condyle of the humerus. The diagnostic marks of this injury are, impaired motion, and increased lateral dimensions, of the joint; the fore-arm being inclined inwards. If the course of the ulna be traced upwards, the hand will come in contact with the internal condyle, and the head of the radius may be felt projecting beyond the external condyle on the outer side.

Reduction of this dislocation is effected by flexing the fore-arm, applying extension and counter-extension, at the same time directing the ulna inwards towards its natural situation: generally speaking, but little difficulty will be found in restoring coaptation of these parts, as the ligaments of the joint must be completely torn through.

Partial dislocation inwards.—In this accident the greater sigmoid cavity of the ulna is entirely separated from the internal condyle of the humerus, and the head of the radius occupies the natural position of the former. The diagnostic marks are here exactly the reverse of those in the accident last described: the fore-arm is directed outwards; the projection is on the inner side of the elbow, and is caused by the ulna; whereas, in the last case, it was produced by the head of the radius. The mode of reduction is, however, quite similar, excepting that the ulna must be directed outwards instead of inwards.

Dislocations of the radius from the ulna.—These two bones are articulated with each other at their superior and inferior extremities; they are capable of rotatory motion on each other, giving to the hand the power of pronation and supination. In these actions the radius is the moveable and the ulna the fixed bone; so that in the luxations of these articulations the former is invariably the one displaced.

Dislocation of the superior radio-ulnar articulation.—As the synovial membrane of the elbow-joint forms also the synovial capsule to this articulation, some have considered this accident as belonging to the elbow. I cannot, however, regard this view as correct, although, owing to the continuity of the synovial membrane, the elbow-joint must always be implicated. Inordinate pronation or supination produces this displacement.

Dislocation of the radius forwards.—Forcible supination is generally the cause of this accident: the head of the radius is driven against the fore part of the coronary ligament, sometimes tearing through its fibres. In that case it slips out of the lesser sigmoid cavity of the ulna, upon the front of which it is thrown. The fore-arm and hand become at once permanently fixed in the supinated position, and a depression is felt an inch below the external condyle of the humerus, where the head of the radius should be found projecting. These are the chief diagnostic marks of the injury.

Reduction is not here effected by general extension and counter-extension, but the power is applied exclusively to the radius, by producing forcible pronation of the hand, which tends to direct the head of that bone backwards towards its natural cavity. This object may be assisted by the application of concentrated force upon the head of the radius itself. When reduction has been produced, the fore-arm should be fixed in a state of pronation, compressing the head of the bone to maintain it in its situation. The indications of renewed coaptation are, restoration of the natural shape of the arm, and its re-acquired capability to perform its natural motions.

Dislocation of the head of the radius backwards.—This displacement occurs much more frequently than that just described: it is produced by inordinate pronation of the fore-arm. There are two reasons why the luxation backwards is more frequent than that forwards: the extent of motion is much greater in the pronate than in the supine position of the hand and fore-arm, and the anterior edge of the lesser sigmoid cavity of the ulna projects considerably more than the posterior, which offers less resistance to the displacement of the head of the radius in the latter direction. The diagnostic mark of this injury is the fixed pronation of the fore-arm, from which position no force short of that which will produce recoaptation of the articular surfaces can remove it. The reduction is effected by forcible supination of the radius, the head of which is directed forwards towards the sigmoid cavity of the ulna. When the luxation is reduced, the fore-arm must be fixed by a bandage in the supine position, and a compress applied to the head of the radius, to prevent the recurrence of the dislocation.

A tendency to these accidents is sometimes established by the peculiar kind of employment of an individual. This is particularly the case in strumous constitutions. The mode of treatment must here necessarily be both constitutional and local: the first with reference to the improvement of the health of the patient; the second as to the means to be adopted to overcome the injurious influence of the actions incidental to the occupation upon the part itself.

Dislocations of the inferior radio-ulnar articulations.—Dislocations of this joint are generally described by writers as displacements of the ulna from the radius; but here, as well as in the superior articulation, the radius is the moveable bone, and ought therefore to be regarded as the one displaced, although it is at the same time true that the deformity existing in the dislocation is due to the projection of the ulna.

The radius at this extremity of the fore-arm may be thrown either before or behind, as in the case of its superior portion; and as the causes of the accident, diagnostic marks, and mode of treatment are all similar, a description of them would be a mere recapitulation of the remarks I have already made. I ought, perhaps, to mention that a fracture through the epiphysis at the lower extremity of the radius resembles the dislocation of that bone backwards, owing to the unnatural projection of the ulna in both cases. The diagnosis is, however, easily formed, from the circumstance that the deformity can be removed with great facility in the former, while in the latter it can only be destroyed by reduction of the dislocation.

Dislocations of the radio-carpal or wrist-joint.—The three upper bones of the carpus form a convex surface adapted to the lower articular cavity of the radius and under surface of the interarticular cartilage, and the whole constitutes a ginglymoid joint, possessing remarkable flexibility, its power of extension and flexion being equal; it is also capable of lateral motion, producing abduction and adduction of the hand. These latter motions are, however, limited, in comparison with the former.

The carpal bones may be thrown from their articulatory surface in four different directions; they may be displaced either backwards or forwards, in which case they are thrown entirely out of their natural cavities; and they may be dislocated towards either side; but in the latter instance the displacement is not complete, owing to the great extent of lateral surface, compared with that extending from before to behind.

Dislocation of the carpus backwards.—This accident is usually the effect of a fall upon the hand while the latter is pronated, so that the dorsal surface of the metacarpal bones first receives the blow, which throws the carpus upon the back part of the radius. The diagnostic marks of the accident are,—permanent flexion of the hand, shortening of its palmar region (in which the extremity of the radius may be felt), and great general deformity of the whole, from the abnormal position in which it is fixed relatively to the bones of the fore-arm. The dislocation is reduced by making extension of the hand, and pressing the carpus forwards at the same instant. The requisite force may be so readily applied that there is generally but little difficulty experienced.

Dislocation of the carpus forwards.—This displacement is much rarer than that just described—a circumstance scarcely to be expected, from the anatomical conformation of the parts, as the posterior edge of the articular extremity of the radius forms a projection which would appear more likely to prevent displacement backwards than forwards: the tendency to the former arises, however, from the preponderating force of the flexor over that of the extensor tendons. Nevertheless, the dislocation forwards sometimes occurs; it is characterized by permanent extension of the hand, diminution of its dorsal length, and by its general change of form with respect to the fore-arm. The reduction is effected in the same manner as in the last case, excepting that the carpus is to be forced backwards towards the radius, instead of forwards, while at the same time an endeavour to flex the hand is made.

Lateral dislocations of the carpus.—In these the carpus may be thrown either partially outwards or inwards, the hand being permanently abducted or adducted, according to the direction in which the displacement has taken place; the deformity presents a sufficiently strong diagnostic mark of the nature of the injury. Reduction is effected by extension and counter-extension, during which the displaced carpus must be directed towards its natural articular cavity. The after-treatment bears reference to the prevention of subsequent inflammation, rather than to any immediate injury to the parts. The joints collectively forming this articulation are numerous, as are also the thecæ connected with the flexor and extensor tendons: it therefore becomes of the highest importance that every precaution should be taken to prevent an accession of inflammatory action, which may assume the chronic form, and, by leading to ulceration, terminate in the destruction of the whole joint. The treatment is similar to that recommended in cases of severe sprain; but it must be remembered that dislocation is a far more severe injury, and therefore requires more urgent means to prevent ill effects from ultimately accruing.

Dislocations of the bones of the carpus and metacarpus.—The bones of the carpus and metacarpus together form the palm of the hand. The character of their motions does not entitle them to be considered as diarthrodial joints, as they are individually uninfluenced by the action of muscles, and only move as a whole, their articulations having merely sufficient motion to protect them against injury from concussion. They must therefore be regarded as amphiarthroses. No surgical author describes the luxation of the bones of the carpus and metacarpus from each other; and, indeed, it does not appear that this accident can occur, excepting from the application of a highly concentrated force, as in gunshot wound, or accident from machinery. In such an instance, however, the soft parts would be so excessively injured, and the bone probably so much comminuted, as to render its removal, or even amputation of the limb, immediately necessary.

I have known the os magnum to be dislocated backwards from its articulation with the scaphoid and lunar bones. The subject of this accident was a carpenter, an out-patient of my colleague, Mr. Callaway. In this case, the appearance was that of a hard fixed tumour on the dorsal surface of the carpus: the man described the injury to have been originally caused three years before, by a very forcible grasping exertion of the hand. The displacement frequently recurred, and he could generally slip the bone back into its place by pressure of his thumb. On this occasion Mr. Callaway easily reduced it in the same manner. The dislocation soon, however, again occurred; and I had afterwards frequent opportunities of seeing and examining the case, which was the only one of the kind I ever met with. Boyer mentions that he had seen it two or three times. I have seen the compound dislocation of the carpus on several occasions, being generally produced in gunshot wounds; but in one case the accident occurred to a labouring man, who, in removing a garden-roller from a cart, suffered it to slip from his grasp, his hand being between the stone cylinder and the iron-work: the force separated the carpus from the radius, and several of the bones of the carpus from each other—inflicting, indeed, such extensive injury as to render immediate amputation of the hand requisite.

The bones of the metacarpus are so closely articulated at their upper extremities with the carpus and with each other, that luxation seems scarcely possible, excepting under circumstances similar to those that can effect dislocation of the bones of the carpus. The metacarpal bone of the fore-finger and that of the little finger possess a slight degree of lateral motion under the influence of their respective abductor and adductor muscles; but this motion is too limited to affect the surgical considerations that belong to these bones. It sometimes happens, however, that they are injured by the overstretching of their ligaments: they then require leeching, and the adoption of other means calculated to subdue the consequent inflammation.

Dislocations of the fingers.—The upper phalanges present concave surfaces adapted to the convex extremities of the metacarpal bones. In consequence of the rounded surfaces of the latter extending farther forwards than backwards, it is scarcely possible that the first phalanx can be luxated towards the palm of the hand: its displacement backwards on the dorsal surface of its metacarpal bone is, however, less rare. The other phalanges of the fingers are also liable to dislocation in the same direction; and I have seen the inferior or last phalanx dislocated forwards, in an attempt to catch a cricket-ball passing above the head. The thumb, which possesses no metacarpal bone, is liable to have its first phalanx displaced from the os trapezium, and I have seen it (in different cases) thrown forwards and outwards. Dislocations of the thumb are, however, rare. Some time since, Mr. Cock had a case of a dislocation of the first phalanx of the thumb upon the dorsal surface of the trapezium and trapezoid bones. He attempted its reduction in the usual manner, but could not effect recoaptation until he had submitted the patient to the influence of chloroform, after which he succeeded with the greatest ease.

The following is a case of dislocation of the last phalanx of the thumb, also under the care of Mr. Cock. Joseph Rosseter was admitted into Cornelius ward, June 29, 1848. Walking over some bars of iron, he stumbled, and, putting out his hand to save himself when falling, received the following injury:—A dislocation of the last phalanx of the thumb backwards, with a wound on the anterior or palmar aspect of the joint, about half an inch in length, exposing the articular head of the first phalangeal bone.

Reduction was effected by Mr. Cock, by means of a large key; extension was made, and when the articular extremity of the last phalanx was brought on a level with that of the first, the joint was suddenly flexed, and the bone returned to its place.

Violent inflammation was set up about the joint, and leeches were applied. Matter formed and was let out; the hand was kept on a splint, and poulticed. The wound over the joint gradually closed, and when quite so, passive motion was used. About six weeks from the time of his admission, he was discharged quite recovered, being able to use his thumb well, and having perfect motion in both joints.

There is often considerable difficulty in reducing luxations of the phalanges, particularly if the attempt be not made until some time after the injury has occurred. In consequence of the small size of the phalanx, it is not easy to apply mechanical force to it sufficient to restore the bone to its natural position: the better plan is to fix to it a piece of tape in the form of a "clove hitch:" this will afford the necessary hold, and the reduction will be greatly facilitated. The after-treatment, as in all the other injuries to joints, consists in maintaining complete rest, and subduing every sign of inflammation the moment it presents itself.

LECTURE XXIX.

DISLOCATIONS OF THE HIP-JOINT.

Hip-joint a true enarthrosis—Remarkable for its great strength—Mode of articulation — May be dislocated in four different directions — Upwards and backwards upon the dorsum ilii — Backwards into the ischiatic notch—Downwards and forwards into the foramen obturatorium—And upwards and forwards on the pubes — May be mistaken for fracture of the neck of the femur—Reduction of dislocation of the hip-joint—Application of mechanical force—Constitutional means—Use of anæsthetic agents—Mode of reduction of each particular dislocation.

The hip-joint offers the best example of the true enarthrosis: it is remarkable for its great strength, which is derived equally from the manner in which its articulatory surfaces are adapted to each other, and from the power and number of its muscles. The head of the thigh-bone is deeply seated in the cavity termed the acetabulum, which is rendered still deeper by a rim of fibro-cartilaginous tissue, termed the cotyloid ligament. The head of the femur is also retained in its situation by an interarticular ligament, the ligamentum teres, and a strong capsular ligament firmly encloses the whole. Fourteen muscles give it its appropriate motions; and some of these muscles, being intimately connected with the capsular ligament, add greatly to the strength of that tissue.

Notwithstanding the variety of means which thus tend to strengthen and preserve the hip-joint against injury, it is not very unfrequently subject to the displacement of its articulatory surfaces: in this accident the head of the bone may be thrown in four different directions. It is true that the head of the femur may be thrown from the acetabulum in every direction from the centre of the circle in which it moves; but, owing to the preponderating power of certain muscles, it is almost invariably fixed in one of four specific positions: firstly, it may be displaced upwards and backwards upon the dorsum of the ilium; secondly, backwards into the ischiatic notch; thirdly, downwards and forwards into the foramen obturatorium; and fourthly, upwards and forwards upon the pubes.

To produce these various displacements under ordinary circumstances, a very considerable exertion of force is necessary; cases have been known, however, in which dislocation of the hip has occurred spontaneously.

In February, 1843, I saw, at Guy's Hospital, a Mr. Edwards, æt. 54, a watchmaker, who resided at 17, High-street, Shoreditch; he had been able, as long as he could remember, to dislocate both hips at will, and also to reduce them merely by his own muscular efforts. This person was the subject of a vesicular eruption of the skin, from which continually flowed so profuse a discharge of serous fluid as to render it necessary for him to change his linen two or three times during the day.

Dislocation upwards and backwards upon the dorsum ilii.—This is the most frequent of the luxations of the thigh-bone: it usually happens in consequence of a heavy weight falling upon the dorsal surface of the pelvis while the individual is in a stooping position, as in the act of digging, or from a fall from a height when carrying a burden. The diagnostic marks of the injury are, immobility of the joint, and great shortening and inversion of the limb, so that, in the erect posture, the toes on the injured side rest on the tarsus of the opposite foot; the knee is also partially flexed, and in advance of the sound one. The roundness of the hip is lost by the ascent of the head of the thigh-bone upon the dorsum of the ilium, and consequent relaxation of the glutei muscles; the trochanter major is thrown beneath the anterior and superior spinous processes of the ilium, with which it is brought into unnatural proximity. The body of the patient is bent forwards, by the tension of the psoas and iliacus muscles, which are tightly drawn over the pubes, all the other muscles being relaxed by the approximation of their points of attachment. In this, as well as in every other dislocation of the hip, the capsular ligament and the ligamentum teres are torn through.

The degree of shortening which takes place in this accident depends upon the time that may have elapsed after the infliction of the injury, as the muscles experience a permanent contraction, which tends constantly to draw the head of the bone still higher, sometimes even, to the extent of three inches. This last circumstance constitutes the chief diagnostic distinction between the dislocation on the dorsum ilii and that into the ischiatic notch. In patients of spare habit, all the signs are so obvious that the nature of the accident is easily detected; but in stout, robust individuals there may be some difficulty; nevertheless, the permanently fixed state and inversion of the limb are generally sufficient to form the foundation of a just diagnosis, which will be rendered still clearer by examining the patient in the recumbent, sitting, and erect postures severally, as each of these different positions portrays some distinct features completely characteristic of this particular dislocation. The impossibility of producing eversion of the limb, owing to the head of the bone resting on the flat surface of the ilium, constitutes a further very strong diagnostic mark of this accident.

Dislocation backwards into the ischiatic notch.—The head of the bone is in this case thrown behind the acetabulum, at the point of junction between the ilium and ischium, and a little above the level of its natural situation; the upward direction is, however, so slight as scarcely to cause any appreciable shortening of the limb, which is inverted, as in the accident I have just described; the knee is also directed forwards, so as to cross the centre of the other thigh at about the commencement of its lower third: indeed, the diagnostic marks which distinguish this dislocation from that on the dorsum ilii only consist in the lesser degree of shortening of the limb, and greater advancement of the knee, in consequence of the head of the bone being thrown much farther behind the acetabulum; the fixed inversion of the limb being about the same in both cases. From the depth of the situation of the head of the bone in this accident, it is sometimes with great difficulty that it can be felt on examination; not that the difficulty arises from its sinking, as some have described, into the ischiatic notch, which is not by any means large enough to receive it, but from the parts themselves being so deeply seated. The suffering of the patient is generally much greater in this than in the former accident—a circumstance which probably arises from the head of the bone pressing upon the great sciatic nerve, by which a sense of numbness is often produced down the whole of the affected thigh. The mobility of the dislocated thigh, with respect to its rotation outwards, is rather greater than in the dislocation on the dorsum ilii, in consequence of the head of the bone resting on the rotator muscles, which yield in some measure to the force employed in the attempts to produce motion in that direction.

The following is a case of dislocation between the ischiatic notch and the acetabulum:

John Forster, a healthy boy, only seven years old, was admitted into Accident ward. He was brought from Deptford about an hour and a half after the accident, which resulted from falling with a younger brother on his back.

The exact nature of the accident was at first rather obscure; the limb was very little shortened, and not so much inverted as in dislocations on the dorsum ilii, but the great trochanter was more nearly on a level with the superior spinous process of the ilium, than on the other side; abduction caused great pain, and could be carried to a very slight extent; and the head of the femur could be indistinctly felt (on rotating the limb) just on the posterior margin of the acetabulum, between the latter and the ischiatic notch.

Counter-extension and extension being made in the usual manner, but without mechanical assistance, the head of the bone almost immediately slipped into its place.

Dislocation downwards and forwards into the foramen obturatorium.—In this injury the diagnostic marks are so characteristic as to render its nature at once obvious. The limb is considerably lengthened, and the thigh on the injured side widely separated from the other, the knee being at the same time advanced; the foot is slightly everted, and the toes alone rest upon the ground; the pelvis is bent upon the thigh, owing to the tension of the psoas and iliacus muscles, and the fore part of the thigh is flattened, in consequence of the general state of extension of all its muscles. If the patient be placed in an erect posture, and then attempts to walk, he moves exactly in the same manner as a man in the act of mowing. The head of the displaced bone may be felt on the inner and superior part of the thigh, and the distance between the anterior superior spinous process of the ilium and the trochanter major is considerably increased, and the two brought nearly in the same vertical line. The capsular ligament is in this accident necessarily torn through; and (although some do not believe this to be an invariable concomitant) the ligamentum teres must, in my opinion, always be ruptured. This dislocation generally occurs from a fall on the feet or knees while the thighs are widely separated: the head of the bone is thus pressed upon the weakest part of the capsular ligament, and being in this direction less restrained by the ligamentum teres than in any other, the capsular ligament is ruptured before the ligamentum teres can exercise its limiting power, and displacement is even effected before the latter gives way.

The lengthening and abduction of the limb, and the permanent separation of the thighs, furnish an unmistakable diagnosis of the accident.

Dislocation upwards and forwards on the pubes.—This is a less frequent accident than those hitherto mentioned; I have seen only four instances of it in the course of my own practice: it may be distinguished from every other luxation of the hip-joint by the permanent outward rotation of the whole limb, and by the head of the bone being felt just below "Poupart's ligament," presenting in thin persons a distinct tumour in the groin; the anterior crural nerve is sometimes pressed upon to such a degree as to produce numbness and pain along the whole of the thigh, and the trochanter major is brought abnormally near to the anterior superior spinous process of the ilium. The impossibility of rotating the injured limb inwards, marks indubitably the nature of this accident.

Dislocation on the pubes is the only luxation of the hip likely to be confounded with fracture of the neck of the thigh-bone, being, like the latter accident, characterized by shortening and eversion of the limb; but the complete fixity in dislocation, and the facility with which the bone may be moved in fracture, constitute, however, a most unequivocal distinction between the two kinds of injury.

Some authors have described a fifth dislocation, in which the head of the femur rests upon the ilium immediately below and rather towards the inner side of the anterior and superior spinous process. This is, however, only a slight variety of the dislocation forwards on the pubes, the head of the bone having been prevented —probably from the imperfect laceration of the capsular ligament —from passing sufficiently far forwards to constitute the complete pubic dislocation.

Mode of reduction of the dislocations of the hip-joint.—When we consider the immense strength of the muscles of the hip-joint, we cannot fail to understand at once that in cases of luxation great mechanical force must be requisite to overcome their powerful opposition to the restoration of the bone to its normal situation. It is, therefore, advisable, particularly in very athletic persons, to employ constitutional means to lessen the contractile power of the muscles before such force is resorted to,—and bleeding, warm bath, tartarized antimony, tobacco enemata, have all been employed with this view. Among all these I prefer bleeding to faintness, with the administration at the same time of continued small doses of tartarized antimony; the blood should however be withdrawn in the erect position, and with the other precautions I have mentioned in my introductory remarks on the general treatment of dislocation.

Mode of reducing the dislocation on the dorsum ilii.—The patient must be laid on his back upon a table placed between two fixed points, which are at a proper height to permit of the extending and counter-extending powers being fastened to them; the girth by which the counter-extending pulleys are attached to the patient should be well padded, and passed between the thigh and the genital organs, while the extending pulleys are fastened to a band applied tightly just above the knee: and the extending and counter-extending forces are always brought into operation in the same line, which is exactly to correspond to the abnormal direction assumed by the injured thigh. When the whole apparatus is effectually arranged, slight tension of the pulleys should be made, so that the muscles may be put somewhat on the stretch, and a short time should be allowed for them to become fatigued before additional force is applied. A steady and gradual effort must then be continued until the head of the femur begins to move towards the acetabulum, indeed, until it has reached the edge of that cavity; this may generally be ascertained by examining the relative situation of the trochanter major with the anterior and superior spinous process of the ilium, which can be felt, however stout the patient may be. When the head of the bone has been brought into the position mentioned, the limb should be gently rotated outwards, and its head directed into the acetabulum; but, as I have before remarked, restored coaptation is not indicated by any sudden snap, for as the muscles are under the influence of the extending power, they are not capable of exercising any contractile force to suddenly draw the displaced bone into its natural situation. Indeed, from the depth of the hip-joint, from the abnormal appearance of the limb under extension, and from the position of the patient, no distinct manifestations of recoaptation are to be expected; and there is always some difficulty in knowing when the reduction is really effected. When it is, however, ascertained, by the restored motion of the limb, that the luxation is indeed reduced, it only remains to bring and maintain the thighs together, to prevent the recurrence of the accident, and to preserve that degree of quiescence of the joint necessary for the reparation of its injured structures. At the same time, the soft parts may have suffered some injury from the apparatus, and in that case medical treatment will be requisite to prevent any ultimate ill effect.

Mode of reducing the dislocation into the ischiatic notch.— There is but little difference between the means employed for the reduction of this dislocation and that just described; the extending and counter-extending apparatus are applied in a similar manner, but the patient is laid on his sound side instead of upon his back; and from the greater obliquity of the dislocation, the line of extension and counter-extension must be at a much greater angle with the trunk — while lying upon the table — than in the former case; indeed, the angle does not here amount to more than 130° or 135°, while in the former dislocation it was at least 165°. In consequence of the head of the bone being so deeply seated in this accident, great resistance is offered to the extending force, and much advantage is derived from placing a towel or handkerchief under the superior part of the thigh, and raising it, as the extension proceeds, so as to assist in extricating the head, and in lifting it over the posterior edge of the acetabulum. Boyer has stated that this dislocation may be secondarily produced, after dislocation upon the dorsum of the ilium. I confess, however, that I cannot comprehend how, in the limited motion of a dislocated limb, the muscles could possess sufficient power to produce that change of position, particularly when we take into consideration the great strength of the glutei muscles compared with that of the rotators outwards, which could alone have a tendency to draw the bone further downwards and backwards. Such an effect might, perhaps, be produced during an attempt to reduce the dislocation on the dorsum ilii, and the surgeon might suppose that he had restored natural coaptation, when in fact he had only drawn the head of the femur down behind the cavity of the acetabulum. I have, in two or three cases of dislocation of the thigh-bone on the dorsum ilii, known it to be a matter of dispute, whether it was a dislocation upwards, or backwards into the ischiatic notch; the question arising out of the degree of shortening, and the backward direction in which the head of the bone had been drawn; for it often happens that the head of the bone is driven into an intermediate position between the two points already mentioned,—its situation being modified according to the comparative strength of the muscles acting upon it, and by the direction of the force which caused the luxation.

Reduction of the dislocation into the foramen obturatorium.—The mode of reduction is here regulated by precisely the same principles as those which regulate the processes for restoring coaptation of the other dislocations, excepting that the extending and counter-extending powers are employed in a different direction to that used in the other displacements of the hip joint; and although a surgeon might detect at once the nature of the injury which his patient had sustained, still he would be perfectly incapable of relieving him, or, at least, not without doing him a severe injury, unless he completely understood the best mode of applying the necessary force.

The patient should be placed upon the table upon his back; and the extending force applied by passing a girth around the upper part of the affected thigh, so high, indeed, as to be in contact with the perinæum; the end of this strap is to be fixed to the hook of the pulleys, which are attached to the staple on the injured side of the patient, while the counter-extending force or apparatus, for the purpose of fixing the pelvis, is composed of a girth, which is completely to surround both the ilia; passing at the same time through the noose formed by the girth attached to the dislocated limb, and being fixed to the opposite staple, the two girths during the application of the extending power are thus made to fix each other, and operate at right angles to the long axis of the body. The surgeon should now, the apparatus being properly adjusted, make gradual extension upon the pulleys, until the head of the femur can be felt moving from the foramen obturatorium; he is then to place himself by the ankle of the sound limb, and by passing his arm beneath it, is to grasp the ankle of the dislocated extremity; when drawing it towards the middle line of the long axis of the patient's body, he acts upon the head of the dislocated femur with a most powerful lever, and under common circumstances readily reduces the dislocation. If the surgeon were to pass his arm above the sound limb, instead of behind it, he would not so readily effect the reduction, as he would then produce a tendency to the depression of the head of the femur, while, by the contrary mode, he elevates the bone.

The prognosis in this dislocation seems more favourable than when the head of the bone is thrown upon the dorsum of the ilium; and the result of Sir Astley Cooper's experience seems to be, that the patient sooner recovers the use of the joint, and in every way sustains less injury. Should any great difficulty occur in reducing this dislocation, by the mode which has been described, it seems to me that the reduction might be facilitated by drawing the table so far from under the patient, during the application of the extension, as to bring the buttock upon its edge; and then while the surgeon is drawing the dislocated limb towards the central line of the patient's body, an assistant could, by pressing the inferior extremity of the femur downwards and backwards, tilt the head of the bone forwards; the edge of the table acting as a fulcrum. The student should remember, in taking a retrospective view of the mode employed for adjusting the apparatus for making extension and counter-extension, that they form a continuous line with each other; but this line, instead of producing an angle of 165° with the patient's body, as in the luxation on the dorsum, in this dislocation forms very nearly a right angle with it. It is by a knowledge of these principles, that one surgeon is ready in the immediate employment of the best means for the restoration of an injury, while another stands aghast, hesitating at least, if not ignorantly inactive.

On Sunday, Feb. 6th, a woman was admitted into Guy's Hospital, under the care of my colleague, Mr. Cock. She was the subject of dislocation of the femur into the foramen obturatorium: every diagnostic sign of this injury was strongly marked, and Mr. Cock immediately proposed the administration of chloroform, which produced complete relaxation of the voluntary muscles; and he proceeded to apply the apparatus I have already described, for the reduction of the dislocation. On drawing the dislocated foot towards the sound one, and even before it reached the mesian line, the head of the bone snapped into the acetabulum; this evidence of restored adaptation being always to be heard in this dislocation, owing to the extension being produced in a transverse, and not in a longitudinal direction.

Mode of reduction of the dislocation forwards and upwards on the pubes.—In this dislocation, the patient is placed on the sound side, and the extending and counter-extending forces applied, as in the dislocation on the dorsum ilii; but as the limb in this accident is thrown backwards, in order to make the extension and counter-extension continuous with each other, it is necessary that the latter should pass before instead of behind the patient's head. In this dislocation, a towel or handkerchief should be placed (as in the last mentioned case) under the upper part of the thigh, to assist in directing the head of the bone towards the acetabulum; a slight rotatory motion outwards appears also to facilitate this object.

In all these varieties of dislocation, I have described the necessity for the employment of mechanical means to effect reduction; and I shall now direct your attention to the high importance of endeavouring to arrive at a due estimate of the amount of force admissible in such cases, without incurring the danger of severely injuring the patient. The degree of violence that may be used must of course depend upon numerous circumstances,—as the age, sex, muscular power, constitutional peculiarities, and state of health of the patient; and there are few points in surgery in which it is so difficult to arrive at just conclusions, as with regard to the amount of force that can be safely applied in surgical operations; as, for example, in reducing a hernia, or passing a catheter in case of stricture. The term force in its surgical sense is extremely indefinite in its signification, and must be always understood relatively, and not positively.

The French surgeons have attempted, in cases of dislocation, to measure the force employed in the extension, by means of an instrument applied to the apparatus; by this arrangement, although in an individual case, its utility is not very manifest, surgeons are enabled to arrive at a kind of statistical average of the requisite power, which, under due consideration of the peculiarities of the case, they can apply with a degree of judgment scarcely to be attained without such an indicator of the amount of the extending force employed: the power of the pulleys, without some such contrivance, may be gradually increased to the destruction of all the tissues connecting the limb to the body, and occasionally the most serious accidents have occurred from the injudicious application of these powerful accessories.

The introduction of anæsthetic agents into surgical practice has added a new feature to the treatment of dislocation; and I believe that if any case exists in which chloroform can be employed with signal advantage, and at the same time without danger of producing ulterior mischief, it is dislocation. Not only does chloroform, in consequence of its usually destroying the contractions of the muscles, take the place of all the old preparatory treatment, by warm bath, tartarized antimony, &c., but it may likewise render the pulleys and other mechanical means of reduction unnecessary; as when the muscular system is relaxed, under the influence of chloroform, there is generally no difficulty in restoring the head of the displaced bone to its natural situation without the employment of any considerable amount of force.

It sometimes happens, however, that from the peculiar idiosyncrasy of the patient, the chloroform, instead of producing relaxation of the voluntary muscles, will throw them into a state of tetanic contraction, in which case the ordinary difficulties of reducing dislocation are materially increased. The usual treatment by bleeding, warm bath, and tartarized antimony, must then be had recourse to, in consequence of the failure of the anæsthetic effect of the chloroform in producing muscular relaxation.

LECTURE XXX.

CONTINUATION OF DISLOCATIONS OF THE LOWER EXTREMITY.

Dislocation of the knee-joint—Character and composition of this joint—Dislocation of the patella—Cause—Diagnosis—Treatment—Cases—Dislocations of the tibia from the femur—Dislocation of tibia backwards—Diagnosis—Dislocation of tibia forwards—Diagnostic marks—Treatment—Lateral dislocations of the tibia—Treatment—Displacement of the semilunar cartilages—Symptoms — Treatment — Tibio-fibular articulations, not liable to dislocation—Excision of head of fibula—Case—Dislocations of the ankle-joint—Usually attended by fracture of the fibula—Dislocations of astragalus inwards — Treatment — Compound dislocation—Dislocation of astragalus outwards—Case—Dislocation backwards—Treatment—Dislocation forwards—Dislocation of the bones of the tarsus.

Dislocation of the knee-joint. — Of all the joints of the body, this is, perhaps, the most intricate in its composition; for, although the articulatory surfaces of the bones constituting it present large surfaces for contact, still they would be but ill adapted to maintain coaptation, were it not for the presence of the interarticular cartilages, and the strong ligaments which hold the bones together.

The condyles of the femur, the superior extremity of the tibia, and the posterior surface of the patella, each covered by articular cartilage, unite to form this articulation. The internal condyle of the femur is longer than the external, and this peculiarity of form is necessary, as, in consequence of the oblique direction which the bone takes, it could not otherwise be adapted to the surface of the tibia, which receives the condyles, and which is perfectly horizontal. If you place a thigh-bone with its condyles resting on a plane surface, the shaft of the bone will not be perpendicular, but more or less oblique, as it was naturally in the skeleton. The object of this arrangement is to give the breadth requisite for the outlets of the pelvis, and the support of the trunk; and at the same time to preserve the lower extremity near to the central line of gravity, in order that, during locomotion, the body may be easily balanced without rendering any great exertion necessary every time its weight is shifted from one foot to the other.

The most frequent dislocation to which the knee-joint is liable, is that of the patella from its articulatory surface with the femur.

Dislocations of the patella.—Boyer, in speaking of these accidents, states that the patella may be luxated upwards, downwards, inwards, or outwards; but says, at the same time, that the two last only, properly speaking, merit the name of luxation. Sir Astley Cooper says the patella is liable to be luxated in three directions—outwards, inwards, and upwards; but according to the common acceptation of the term dislocation, I should consider the displacement upwards and downwards as rupture of the tendons of the extensor muscles of the knee-joint, or of the ligamentum patellæ. The dislocation of the patella inwards or outwards is caused by the application of some force upon either of its edges, so as violently to drive it in one of these directions; producing at once an incapability of bending the knee, and causing a projection which renders the nature of the accident sufficiently obvious.

The dislocation *outwards* is most frequent; it is, however, scarcely ever complete, the patella being usually thrown upon the articular surface of the external condyle. This accident is generally produced by a blow on the inner edge of the patella when the foot is everted; or in some persons, who are in-kneed, the displacement may be produced, merely by the action of the extensor muscles of the leg; but in these subjects, there is generally a relaxation of the ligamentum patellæ, rendering them particularly liable to the accident. Boyer speaks of a peculiarity of form of the external condyle of the femur as a predisposing cause to the displacement of the patella, and mentions the cases of three military conscripts, who were the subjects of this malformation, and had consequent displacement of the patella from their birth. If the dislocation be complete, the anterior surface of the patella must be turned outwards; its articulatory or posterior surface inwards; its internal edge forwards; and its outer edge backwards: the knee presents, on viewing it anteriorly, a deep depression, pointing out how completely the displacement of the patella deprives the joint of its ordinary form.

The dislocation *inwards*, which is of very rare occurrence, does not differ from the preceding accident, except that the projection is situated at the opposite side of the joint; the diagnostic marks, the mode of treatment, and the result of the accident, are similar. The peculiar direction of the knees inwards prevents this dislocation occurring so frequently as that outwards.

The mode of reduction, when the patella is thrown from its relative position with the articulatory surface of the femur, must be at once obvious—namely, to place the only opposing force, the extensor muscles of the leg, in a state of relaxation, which may be effected by laying the patient in the horizontal position, with the injured leg extended, but the thigh flexed upon the pelvis; while in this position, the patella is to be forced by the surgeon, either inwards or outwards, according to the direction of the luxation. I usually effect the reduction by placing the patient in the recumbent posture, and, elevating the whole extremity, rest his heel on my shoulder, being myself in the sitting posture; in this position the extensor muscles are completely relaxed, from the extension of the knee and flexion of the thigh upon the pelvis. It is at the same time the most favourable position for the manipulation necessary to replace the bone. These means should be employed as soon after the accident as possible, or the inordinate contraction of the irritated muscles may render the reduction difficult. When the patella is restored to its proper situation, bandages should be applied to preserve the bone in its position, from which it otherwise has a great tendency to be easily displaced. Leeches and evaporating lotions are also required to prevent subsequent inflammation, and a splint should be placed behind the joint, to prevent both the voluntary and involuntary motions of the limb.

Of the dislocation *outwards*, I have seen several instances, both in public and private practice; but generally they have been the result of the action of the extensor muscles of the leg, from an unnatural direction of the knee inwards, and not from the application of any force immediately to the bone itself.

A young lady consulted me, who frequently dislocated her patella outwards, merely by striking her toe against the carpet, and once or twice it has occurred while dancing; she was always able to reduce it by straightening her limb to the fullest extent, and then, bending down to grasp the patella, (unconsciously relaxing the extensor muscles,) had no difficulty in pushing the bone back into its place. She stated that she suffered extreme pain while the patella was displaced, and during that time was perfectly unable to walk.

There was lately a boy in Stephen's ward, who, in falling out of bed, dislocated his right patella outwards. It was, however, readily reduced, in the manner which has been described. This boy was the subject of hip-disease on the right side, and, therefore, the consequent inward direction of his knee rendered him particularly liable to dislocation of the patella.

Dislocations of the tibia from the femur.—The femur and the tibia are united at the knee-joint by such strong ligaments, and the articulatory surfaces are so large, that it scarcely seems possible for dislocation of this joint to occur; indeed, nothing but the application of great force can separate the bones.

The prognosis in this accident is unfavourable; for, owing to the great extent of the articulatory surfaces, their complete separation is never effected without producing at the same time serious injury to the surrounding soft parts. It is possible, however, that partial dislocation may sometimes be produced by the operation of a comparatively slight force; as when, for example, the knee-joint is semiflexed and advanced, as in the act of progression, it being then to a certain degree unprotected by the tension of the muscles.

The tibia may be displaced from the femur in four different directions—viz., posteriorly, anteriorly, outwards, and inwards.

Dislocation of the tibia backwards.—The dislocation of the tibia backwards is more frequent than that forwards; but it is scarcely possible, in this case, that the bones can be sufficiently separated to constitute a complete luxation, without so much injury being inflicted on the soft parts as to render the dislocation compound, immediate amputation being necessary. In this injury, the head of the tibia is thrown behind the condyles of the femur, and rests in the poplitæal space, the hollow of which it fills. The patella forms an eminence at the extremity of the femur, and below it a deep depression is felt; this is bounded posteriorly by the tubercle of the tibia, which is drawn far behind its natural position; the leg is projected forwards, being permanently extended to an unnatural degree, by the extensor muscles acting around the protruding condyles of the femur. Some surgeons have stated that in this accident the knee-joint is sometimes flexed; but this can only occur from the laceration of the ligamentum patellæ, in which case the flexor muscles might, perhaps, draw the leg backwards.

Although this dislocation offers a very frightful appearance, the difficulty of reducing it is not so great as would be expected from the extent of the deformity. This is particularly the case if the coaptation be attempted soon after the occurrence of the accident, for the approach to collapse almost inseparable from so severe an injury, greatly facilitates the operations of the surgeon, from the depression it produces in the powers of the patient.

Case.—In August, 1839, Mr. Solly, of St. Thomas's Hospital, was sent for, to see a gentleman at Walthamstow, who, in attempting to jump over some rails, entangled his leg between them, producing dislocation of the tibia backwards. The patient was a remarkably stout man, and about six feet two inches in height. When Mr. Solly first saw him, the leg was extended forwards, and immoveably fixed, at an angle of about 25° with the thigh. The reduction was easily effected; but after the dislocation was reduced, the lower part of the thigh became much swollen, and fluctuating; neither the anterior nor posterior tibial arteries could be felt, but there was no pulsation in the mass of effused fluid. The dislocated leg was without sensation; and this, and the want of pulsation in the tibial arteries, seemed to indicate laceration both of the arteries and nerves of the leg. The patient was cold, and his pulse feeble; but he was not completely collapsed. Mr. Lloyd, of St. Bartholomew's Hospital, was sent for, and recommended immediate amputation. The patient would not, however, consent to this, and Mr. Tyrrell was subsequently called in. When he examined the case, he considered that the patient was too much depressed to permit of amputation being performed; but, as it was evident some important bloodvessel had been torn through, he thought it advisable to tie the femoral artery, and to leave the limb to nature's efforts. Mr. Tyrrell was principally influenced in his opinion by the result of a case of fractured thigh, with laceration of the femoral artery, which I had some time before treated successfully upon the above-mentioned plan. According to Mr. Tyrrell's proposal, the artery was tied in this case; but the leg sloughed, and the patient died. In the post-mortem examination, the poplitæal vein and artery were found partially torn through, but the nerve was not lacerated, although it appeared to have been violently stretched—which circumstance would probably account for the loss of sensation in the limb, which followed immediately upon the injury.

Dislocation of the tibia forwards.—This is a much rarer accident than that last described,—as may indeed be expected from the character of the motions of the articulation: if, for instance, a blow be inflicted on the upper part of the tibia in front, as the knee cannot be extended beyond a straight line, it receives by its natural resistance the full effect of the force; while, if a similar blow be given on the back part of the limb, it will yield, and thus escape injury.

The diagnostic marks of the dislocation forwards are, permanent flexion of the knee-joint; projection of the head of the tibia below the patella; and protrusion of the condyles of the femur into the poplitæal space, where they may produce so much pressure upon the poplitæal artery, as to stop pulsation in its anterior and posterior tibial branches.

In both these dislocations of the tibia the crucial ligaments must be torn through, and the whole of the structures of the joint suffer such extensive injury as to demand the strictest and most prompt antiphlogistic treatment, to check or subdue the consequent inflammation.

The only complete dislocation of the knee-joint I have ever seen was in the case of a patient of Mr. Cooper, of Brentford, but then the injury was so complicated as to render amputation necessary.

Lateral dislocations of the tibia.—In these displacements the appearance of the joint is quite sufficient to point out the direction in which the tibia has been thrown. In the dislocation inwards the latter is forced towards the mesian line of the body; the internal condyle of the femur rests upon the outer articulatory surface of the tibia, which itself forms a projection on the inner side of the joint.

In the dislocation outwards the appearances are exactly reversed, the displacement being from within to without: these dislocations are, however, never complete.

In the reduction of dislocation of the knee-joint, counter-extension must be applied to the thigh, and extension to the lower portion of the limb; the tibia must then be directed towards its natural situation; and, from the reasons I have already given, less difficulty arises in restoring the coaptation of the parts, than in subduing the constitutional derangement produced by the reaction in such an extensive injury. The medical treatment will of course necessarily be regulated according to the peculiarities of each particular case.

I have seen several cases of partial dislocation of the knee-joint, but more frequently as the result of chronic disease than of accident. When the former is the source of the mischief, amputation, in consequence of the disorganization of the tissues of the joint, is generally necessary. In case of accident, however, recovery is almost certain, if the requisite time and rest be allowed, to enable the structures to repair the injury to which they have been subjected.

Case.—James Plunkett, æt. 45, was admitted into Accident ward, in consequence of having injured his knee while landing some coals at Dowgate Dock. The accident occurred from his falling off a ladder with a sack of coals upon his back, with his left knee bent under him, as he describes, nearly at a right angle.

Upon his admission, the knee was found to be in its natural position; his fellow-workmen said that great deformity had been produced by the injury, but that he had restored the joint to its natural form by getting one workman to extend the leg, while he pushed a "lump" (the head of the tibia) outwards into its natural situation. The account he gave, in fact, left no doubt that the accident had been a dislocation of the tibia inwards. It was ascertained that the internal lateral ligament, and some fibres of the vastus internus muscle, had been ruptured: this was indicated by an unnatural hollow on the inner side of the knee-joint, opposite to the space between the two bones. From the extent of the displacement which had been described, it was most probable that the crucial ligaments were torn through. The patient complained of great pain, either upon motion of the limb or the slightest pressure; and although, at the period of his admission, there was but little swelling of the knee, tumefaction came on rapidly in a short time. The limb was immediately placed on a double inclined plane, and secured by a roller loosely applied at the foot; and at the lower part of the thigh twenty leeches were applied, and evaporating lotion ordered to be kept constantly on the part.

On the evening of his admission, the knee, leg, and thigh were much swollen, with a sensation of considerable heat; the bowels had not been opened since his admission; he was therefore ordered to take the following medicine:

℞ Hydrarg. chloridi. gr. iij.
Ext. coloc. comp. gr. v.
Antim. tartariz. gr. $\frac{1}{4}$. M.
Ft. pil. ij. stat. sumend.

Swelling of the limb still increased, and a considerable ecchymosis became obvious at the upper part of the calf. Twenty more leeches were ordered to be applied, and the evaporating lotion to be continued.

The swelling was soon nearly gone, excepting at the upper part of the calf, where the ecchymosis continued; there was some hardness and swelling perceptible in the situation of the saphena major vein, leading to the supposition that it had been torn through in the accident, and this was further indicated by the enlargement of the collateral venous branches. The patient went on gradually improving from this time; the inflammation of the joint soon subsided: the whip-cord hardness of the saphena diminished, and he shortly left the hospital, able to walk with a stick.

Displacement of the semi-lunar cartilages.—Symptoms simulating those of partial dislocation of the knee sometimes result from the semi-lunar cartilages slipping forwards from between the articulatory surfaces of the femur and tibia. In this accident the joint becomes fixed in a semi-flexed position, and all attempts to produce extension are fruitless. The diagnostic marks are, the apparently extensive injury, all the functions of the joint being suspended, and the circumstance of the accident being caused by a very trifling force,—such as a mere false step in walking. On examining the knee, and passing the finger along the inner edge of the fore part of the tibia, a thin but firm projecting body is felt; this is supposed to be the displaced semi-lunar cartilage; it may sometimes be restored to its natural position by flexing the knee-joint to its fullest extent, and then suddenly extending it: the first action frees the cartilage from the pressure of the femur, and the second draws it back into its normal situation. When the mobility of the joint is restored, leeches, fomentations, and afterwards a blister, should be applied, and a knee-cap worn for a considerable time, until, indeed, the relaxation of the tissues is completely removed.

I confess, notwithstanding this description, I have considerable doubt in my own mind if this accidental condition of the knee-joint really results from a displacement of the semi-lunar cartilages; for when we consider the firmness and complicated arrangement by which these structures are connected to the tibia and ligaments of the knee-joint, it is impossible to conceive that such slight accidents as usually cause the derangement alluded to, should be produced by the detachment of the semi-lunar cartilages; but I am of opinion that all the symptoms result from some adventitious growth within the joint, which has either become detached, or, from the loose manner in which it is connected with the synovial membrane, interferes with the motions of the joint. I have seen several of these cases, and in all the recovery from the injury has not been effected by any sudden relief resulting from the removal of the offending body from the sphere of motion of the joint, but from the slow effects of the antiphlogistic means employed to subdue the resulting inflammation; and in each of these cases, the patient ultimately recovered. I doubt, therefore, the propriety of the violent efforts being employed, which are usually had recourse to in these cases for the purpose of restoring the supposed dislocated cartilage, but am an advocate for the employment of leeches, fomentations, rest, and such means as are best adapted to subdue inflammation.

In treating of the dislocations of the superior extremity, after describing the luxations of the elbow, I passed to those of the radio-ulnar articulations, but now I go at once from the knee to the ankle-joint, as the connexion between the bones of the leg bears little or no analogy to that between the bones which constitute the fore-arm. The articulation of the radius with the ulna forms a perfect diarthrodial joint, which possesses muscles appropriate to its motions; while, on the contrary, the fibula only moves upon the tibia under the influence of external force. The head of the fibula offers so little surface to the action of any external force, that it is difficult to conceive how its dislocation can happen; nevertheless, experience proves that it may be displaced from its articular surface on the tibia. When displacement of the fibula from the tibia occurs, it is usually attended by fracture, and often with comminution of the bone, to so great an extent as to require prompt surgical measures. In compound fracture I have, indeed, known it necessary to remove the head of the fibula from the tibia, an operation which, although it appears easy, requires great precaution; for, owing to the contiguity of the knee-joint, it is extremely difficult to remove the head of the fibula without injuring, directly or indirectly, the synovial capsule of the knee-joint. I have myself experienced the difficulties that attend this operation; for, in amputation of the leg, where extensive laceration had left but little to form a covering, I have in three cases removed the head of the fibula in order to diminish the extent of surface over which the integuments had to be stretched. I was induced to resort to the operation, from the advantages offered in saving the knee-joint, which gives the patient a much better means of support than can be obtained when the amputation is performed above the knee. In one of these cases, violent inflammation of the knee-joint followed the operation, the synovia escaped, and the patient was reduced to a very critical situation; ultimately, however, he recovered. There is a further objection to the removal of the head of the fibula, when it has itself been injured, as in the case of compound fracture; in such an instance we not only have the danger arising from the cause I have just mentioned, but the remaining portion of bone is set free from any attachment at its upper extremity, and must prove a source of constant and excessive irritation to the surrounding muscles.

The dislocation of the fibula from the lower part of the tibia can only occur concomitantly with injury to the ankle-joint, and therefore the considerations referring to this accident will naturally be included in the description of the dislocations of the ankle.

Dislocations of the ankle-joint.—The differing and somewhat indefinite modes of describing the various dislocations of the ankle-joint have given rise to much confusion, and engendered difficulties where none ought really to exist. It appears to me that luxations of the ankle ought to be spoken of invariably as displacements of the astragalus, which is the moveable bone, and that the peculiar character of the dislocation should be distinguished according to the direction in which the astragalus is driven. I shall, therefore, describe the dislocations of the ankle as the displacement of the astragalus—inwards, outwards, forwards, and backwards, from the tibia and fibula.

The form of the articulation of the foot with the bones of the leg is so admirably adapted to the attainment of great strength, and the ligaments that restrain its motions are in themselves so powerful, that, to the view of the anatomist, luxation of the ankle-joint seems scarcely possible; but when we consider the nature of the functions of this joint, and the violence to which it is constantly liable, we shall perceive that accidents to it are indeed comparatively very rare.

Dislocation of the astragalus inwards.—This is the most frequent luxation, in consequence of the malleolus internus not descending so low as the external. The degree of deformity prevents the possibility of mistaking the nature of the accident. The sole of the foot is directed outwards, the inner edge only resting upon the ground, the internal malleolus projects upon the inner side of the articulatory surface of the astragalus, over which the skin is so stretched as to threaten its laceration; the fibula is broken from about an inch and a half to two inches above the ankle-joint, and the lower portion is drawn inwards with the astragalus, so as to lose its natural parallel direction with the tibia. If this accident occurs to a person falling from a considerable height upon his feet, the tibia, as well as the fibula, is liable to be fractured immediately above the malleolus internus, and the astragalus also is sometimes split, in which case the prognosis is unfavourable. It may happen that when the astragalus is dislocated inwards, it may have at the same time a tendency to be thrown backwards; a circumstance indicated by the comparative shortening or lengthening of the foot, and unnatural appearance of the heel.

The mode of reducing the dislocation of the astragalus inwards is, to place the patient in the recumbent posture upon the injured side, the leg being bent at a right angle with the thigh, and the foot extended for the purpose of relaxing the gastrocnemii muscles; an assistant makes extension from the foot, directing it inwards at the same time, while the surgeon presses the tibia outwards, when usually the reduction is readily performed. This, however, depends on the perfect relaxation of the gastrocnemii muscles. I have several times witnessed this accident, and have always found the reduction easy, as the fibula, being broken, offers no resistance to the coaptation of the articulatory surfaces. When speaking of fractures of the fibula, I mentioned the recurrence of a dislocation of the astragalus inwards, merely from the spasmodic action of the muscles, in consequence of splints not having been applied to prevent such an effect; this fact sufficiently points out the propriety, immediately after the reduction has been accomplished, of applying two splints, each furnished with a foot-piece, so as to keep the foot protected from the influence of the muscles. Should there be subsequent inflammation, local or even constitutional means may be required. During the process of the consolidation of the fibula, the outer splint should always be worn with its foot-piece, so as to prevent permanent distortion of the foot outwards.

This dislocation is liable to be rendered compound by the bursting of the skin, which is in a state of extreme tension from the projection of the malleolus internus. When this happens, the reduction of the luxation is difficult, from the manner in which the lower segment of the penetrated skin is puckered in and restrained between the projecting inferior extremity of the tibia and the astragalus; the latter cannot, indeed, be returned to its place without the liberation of the confined portion of skin, and this can only be effected by making an incision commencing somewhat below the projecting malleolus, the knife being insinuated upwards beneath the tibia, to divide the integument, which is tightly bound in by the end of that bone; the loosened skin may thus be turned back, and the bones restored to their natural places. After the reduction is completed, the flaps formed by the operation just described may be easily adjusted so as to assist in the reparation of the injured part.

A very similar condition may arise from the formation of abscess after a simple dislocation of the astragalus inwards.

George Balsac, aged 48, on the 8th May, 1847, fell (by slipping upon a piece of orange-peel), producing simple dislocation of the astragalus inwards, attended by the usual fracture of the fibula (Pott's fracture). The dislocation was easily reduced, but, owing to the pressure of the malleolus internus upon the integument, an abscess subsequently formed, the skin ulcerated, pus was evacuated, and a considerable portion of malleolus exposed to view. Four months after the accident, the man came under my care; anchylosis of the joint was at this time nearly complete, and the protruding malleolus internus was in a state of caries. I determined upon leaving this portion of bone to the process of exfoliation, considering that if it were removed by operation the joint would be exposed, and the anchylosis interrupted. To assist the exfoliation I applied phosphoric acid; the outer layer of the bone was thrown off. The cancellated structure granulated, and the wound soon became cicatrized.

I believe that had I in this case sawn off the end of the malleolus, the exposure of the joint would have rendered subsequent amputation of the foot necessary, while now a stiff ankle-joint is the only inconvenience the patient suffers.

Dislocation of the astragalus outwards.—This accident is generally attended by more severe injury to the neighbouring parts than the last. This is perhaps owing to the projection of external malleolus very much exceeding that of the internal. It is usually accompanied by fracture and comminution of the fibula. In this dislocation the deformity is highly characteristic of the direction in which the astragalus is thrown: the sole of the foot is turned more or less inwards, the outer edge alone resting on the ground, while the malleolus externus projects on the outer side, threatening laceration of the skin. The malleolus internus is also frequently broken in this accident, and the fracture sometimes extends upwards, through the articular extremity, to the shaft of the tibia. It is said that the fibulo-tarsal ligaments sometimes give way before the bone itself is broken. I have never myself witnessed a case of the kind.

The reduction should be effected as soon as possible after the occurrence of the accident. The patient is to be placed upon his back, with the thigh of the injured limb flexed upon the pelvis. Counter-extension is to be made from the leg, while the surgeon, grasping the dorsum of the foot with one hand, and the os calcis with the other, makes the extension, at the same time rotating the whole foot outwards, and directing the astragalus towards the tibia, from whence it has been displaced. The reduction is thus generally effected without much difficulty. Splints furnished with foot-pieces should be immediately adapted to the limb; but only sufficient pressure to maintain the natural position should be employed. Local and constitutional remedies must also be made use of, to prevent the inflammation likely to ensue after so severe an injury. The prognosis here is much less favourable than in cases of dislocation inwards, in consequence of the greater degree of injury sustained by the joint.

When the dislocation of the astragalus outwards is compound, or even when it is complicated by fracture of the malleoli, or of its own body, Sir Astley Cooper has shown that amputation of the foot need not invariably be resorted to. Many instances are quoted where portions of the tibia and fibula have been sawn off, and even where the whole astragalus has been removed with perfect success, the only defect being a stiff joint. Some time since, a boy, who had been under the care of Mr. Bossey, of Woolwich, was admitted into Guy's Hospital with a dislocation of the astragalus inwards and forwards. Although the accident had happened some days previously to the boy's admission, the reduction had not been effected. The whole of the astragalus was exposed; and, as the child was not suffering from any constitutional irritation, I left it to be separated by nature. In a short time it was very easily removed. I then restored the foot to its natural position, and the child soon left the hospital, quite recovered, excepting that the ankle was inflexible. I have also on one occasion successfully removed the astragalus immediately after the occurrence of the accident; but this is not an easy operation, as there is always considerable difficulty in introducing the knife between the astragalus and os calcis, so as to cut through the sub-astragalar ligaments which so firmly unite those bones. Sir Astley Cooper, Mr. Green, and other surgeons, have also successfully performed this operation; but I consider that (at any rate in a crowded metropolis) the result must always be doubtful. At Guy's Hospital, a large proportion of the cases of compound dislocation of the ankle-joint terminate fatally, even where removal of the bone has not been required.

When the dislocation is complicated by laceration of the soft parts, comminution of bone, or rupture of bloodvessels, the necessity for amputation is obvious, and the surgeon should in no wise seek to save the limb at the risk of the life of his patient.

Dislocation of the astragalus outwards, followed by tetanus.—In August, 1839, I had a patient, a man 45 years of age, in Guy's Hospital, who had been thrown off the shaft of his cart, the wheel passing over his ankle, producing a compound dislocation of the astragalus outwards; the foot was thrown inwards, and twisted so much upwards that its inner edge was brought almost parallel with the tibia. Upon examining the injured parts, I found the astragalus broken through its neck, just anterior to the groove in which the interosseous ligaments are fixed to connect it to the os calcis, leaving the anterior portion of the astragalus attached to the navicular bone, while the upper articular surface for the tibia projected with the malleolus externus through the wound. There was, in fact, dislocation of the astragalus from the calcis, complicated with fracture of the astragalus and malleolus externus. I immediately recommended amputation of the limb; but the patient would not consent, and I therefore adjusted the parts as well as I could. I first tried to reduce the protruding portion of the astragalus, but I could not succeed in this, and was consequently obliged to remove it by dividing the external lateral ligaments of the ankle-joint; the foot was now readily returned to its natural position, and a splint was supplied to keep it from being disturbed; the ankle was covered with lint, cold water being kept constantly dripping upon it.

For a few days the patient appeared to be going on well; but on the fourth evening after the accident, he was seized with delirium tremens; three grains of solid opium were given, and the next morning he was better in every respect,—subsequently, however, he had frequent attacks of delirium and rigors, which showed that there existed some continued cause of irritation. An opening was made in the sole of the foot and some pus evacuated; this gave great relief to the patient; but by this time his constitutional powers had become so much depressed that amputation was out of the question. Five days after the accident he was suddenly seized with symptoms of trismus, and it is remarkable that all signs of delirium at once left him: his pulse was 140, small and irritable, but feeble. The foot was looking better, and pus was plentifully discharged from the wound: his body was covered with a cold sweat. I ordered large doses of quinine with wine, occasionally calomel and opium, and purgative enemata, to correct an obstinate constipation; opisthotonos soon came on, and, after lingering for five days from the commencement of the tetanic symptoms, the patient died.

In 1849 I was sent for, to see a gentleman, æt. 64, who had been thrown out of his gig, dislocating the astragalus inwards, producing at the same time compound fracture of the fibula. When I arrived at the residence of the patient, I found that the limb had been perfectly well adjusted by Mr. Brightwell, of Sawbridgeworth, who was first called in, and Mr. Dobson, of Harlow, who had been in attendance with him. The limb was so well placed that I did not think it right to interfere with it, but contented myself with recommending calomel and opium at bed-time, and saline medicine, to allay irritative fever, which had already commenced. Taking into consideration the age of the patient and the unfavourable result of these accidents generally, I felt disposed to recommend immediate amputation, but the feeble and irritable state of the pulse forbade such a step. In consultation, after having seen the patient, some difference of opinion arose between myself and the other surgeons, as to the prognosis of the case. I felt persuaded that the accident would prove fatal; but they, on the contrary, saw no cause of alarm.

The case went on, however, from worse to worse, large abscesses formed at the upper and back part of the calf of the leg, the bone at the seat of injury became daily more exposed by the sloughing of soft parts, and at the end of three weeks the patient died.

I do not believe that the whole of the danger in these cases arises from the injury to the ankle-joint; but that, in consequence of the immense force necessary to displace the articulatory surfaces of this complicated joint, the muscles of the calf of the leg are so severely stretched or even lacerated that much of the irritation must be attributed to this cause, and that the abscesses which almost invariably occur as a sequel to these accidents tend in no slight degree to accelerate their fatal termination.

Dislocation of the astragalus backwards.—This accident is generally produced by the foot meeting suddenly with an obstacle while the person is in the act of running. In such a case the impetus of the body carries the tibia forwards, while the foot is forcibly checked, and the astragalus is thrown behind, usually fracturing the fibula at the same time.

The diagnostic marks of this injury are, shortening of the dorsum of the foot, and unnatural elongation of the heel, the foot being also fixed in the extended position, and slightly rotated inwards. From the fibula being broken, it sometimes happens that the displacement is only partial, the posterior portion of the articular surface of the tibia still resting upon the astragalus, while the anterior part projects over the navicular bone.

The reduction should be performed as soon as possible after the accident; for if it be delayed the difficulties are greatly increased; extension and counter-extension are to be made as in the dislocation outwards. The foot must, however, be rotated, so that the astragalus may be drawn forwards into its normal situation. The after-treatment is in every way precisely similar to that already described.

Dislocation of the astragalus forwards.—I have never seen an instance of this accident, neither does it appear that Sir Astley Cooper ever met with it. I should indeed doubt the possibility of the complete displacement of the astragalus in this direction happening, excepting under such circumstances as would render immediate amputation unavoidable.

Dislocation of the bones of the tarsus.—From the limited motion of these bones upon each other, the great extent of surface in contact, and the excessive strength of their connexion, their displacement is an exceedingly rare accident, but it does sometimes happen, as in the

Dislocation of the calcis outwards from the astragalus.—The following case illustrates very well the nature of this accident:—John Ryley, aged 49, was admitted into Guy's Hospital with a dislocation of the foot. He stated that, in swinging himself out of a cart, he lost his hold, and slipped down upon the kerb-stone, his right foot being turned completely inwards, in which position it remained until he was brought to the hospital. The diagnostic marks of the injury were as follows:—The chief deformity arose from the complete inversion of the whole foot, the sole of which faced directly inwards: the astragalus formed also a very evident deformity; for, although it remained in its natural position with respect to the tibia and fibula, its anterior articulatory surface pressed so tightly against the skin, that, had the dislocation remained unreduced, the integuments must very soon have undergone ulceration: the superior edge of the anterior articulatory surface of the astragalus could be easily felt, and its form was distinctly visible; a deep hollow was also observed below the external malleolus, where there was evidently extensive contusion of the soft parts: the external malleolus formed a considerable projection in its natural situation; but neither it nor any of the other bones of the foot was fractured. From these appearances it was judged to be a dislocation of the calcis and navicular bone with the rest of the foot outwards from the astragalus. The reduction was effected in the following manner:—The surgeon knelt at the foot of the patient's bed, and, grasping the heel with his right hand, made extension from the instep with his left, an assistant at the same time pressing the tibia inwards towards its natural position. The reduction was very easily effected, and the foot regained its natural form, with the exception of the swelling produced by the injury to the soft parts. The leg was laid upon a splint, with a foot-piece on its outer side, and two or three turns of the roller were lightly applied over the foot and below the knee, in order to keep the splint in its proper position. Leeches, and afterwards cold lotions, were applied. During the progress of cure, the patient suffered much pain, and also irritative fever. Pus formed below the malleolus externus, and was evacuated. Gradually, however, the symptoms subsided under the treatment adopted, and the parts rapidly recovered.

Dislocation of the navicular bone from the astragalus, and the cuboid from the os calcis.—This is, in fact, a dislocation of "Chopart's tarsal joint." I once saw it in the case of a man who was admitted into Guy's Hospital. The toes, metatarsus, and anterior half of the tarsus, were twisted inwards. The anterior articulatory surfaces of the astragalus and os calcis formed a projection on the outer side of the foot, the astragalus being so tightly pressed against the skin as to threaten momentary laceration; and a deep hollow, evidently resulting from the displacement of the cuboid bone, could be felt just in front of the os calcis.

Reduction was accomplished by the usual extension and counter-extension, and by forcing the metatarsus outwards, whilc pressure on the bones of the leg in the opposite direction guided the displaced tarsal bones into their proper situation. In this case, considerable constitutional irritation followed the accident, and abscesses formed; but the patient ultimately recovered, the usefulness of his limb being but little impaired.

Sir Astley Cooper has described two cases of dislocation of the internal cuneiform bone, but in neither of them could the displacement be overcome. One of these cases occurred when I was dresser at Guy's Hospital. The principal diagnostic mark was a considerable projection inwards of the internal cuneiform bone, having the appearance of a displacement of the toes outwards. Although the bone could not be restored to its normal position, the patient suffered but little pain or inconvenience from the injury.

The dislocations of the metatarsus and the phalanges of the toes are very rare—much more so, indeed, than those of the bones of the carpus and phalanges of the fingers. A heavy weight falling on the foot, or a carriage passing over it may produce such an injury; but the probable destruction of soft parts and comminution of bone would render immediate amputation indispensable. Should, however, dislocation of the phalanges occur without severe and extensive concomitant injury to the surrounding tissues, reduction may be effected in the same manner as that described in treating of dislocation of the phalanges of the fingers.

LECTURE XXXI.

SURGERY OF THE REGIONS.

Reasons for adopting this system—Calvarian region—Tissues entering into its formation—Extravasation of blood—Wounds of the scalp—Encysted tumours—Emphysema—Abscesses—Temporal region — Opening temporal artery—Aneurism of—Fracture of temporal bone—Region of the ear—Congenital obstructions—Accidental obstructions—Polypi—Lesions of the auricle—Plastic operations—Inflammation of the cavity of the tympanum—Treatment—Obstruction of Eustachian tube—Treatment —Malformation of internal ear—Mastoidal region—Abscess of —Specific ulcers—Base of the skull—Division into anterior central, and posterior portions—Diseases and accidents of each—Advantages of this division—Region of the face —The nose—Its double office—Its diseases—Polypi—Ozæna—Epistaxis—Plastic operations.

In the lectures which I have thus far given, I have only described the morbid conditions of the several tissues of the skeleton. In proceeding with my subject, I think it advisable to consider the different lesions, whether arising from disease or accident, in relation to the regions in which they occur,—a classification which has already been adopted by some French authors, and which has been correctly termed by them "topographical surgery." I regard this arrangement as most convenient and advantageous in every way; and although the shortness of the time allotted for a course of lectures in the London medical session prevents my constantly following the plan, I am thoroughly convinced of its utility, and therefore adopt it in the present instance. According to this mode of procedure, the whole of the surface of the body is divided into localities or regions of definite extent. I shall commence at what is termed the *Calvarian Region.*

The tissues entering into the formation of this region are the hair, skin, cellular tissue, occipito-frontalis muscle and its tendon, and the bones constituting the vault of the cranium. On the diseases of the hair and skin I have but little to say, as they scarcely belong to the province of the surgeon. I shall therefore confine myself to the consideration of such injuries as require direct surgical treatment.

In describing, on a former occasion, the fractures to which the bones of the skull are liable, I spoke of compression and concussion of the brain. I now pass on to the effects which sometimes result in such cases to the structures external to the bone.

Extravasation of blood is one of the most frequent attendants upon injury to the head; it may occur either between the scalp and the occipito-frontalis muscle or its tendon, or beneath that muscle and between it and the pericranium. In the first case, the ecchymosis is confined and circumscribed, in consequence of the density of the subcutaneous cellular membrane; but in the latter, the cellular tissue is so loose in its texture, in order to provide for the free play of the occipito-frontalis muscle over the bones, that the blood becomes diffused over a large surface, and, gravitating towards the inferior surrounding parts, coagulates, and there operates as an extraneous substance, so as frequently to render incisions necessary for its removal,—a course which is never requisite when the effusion is merely subcutaneous.

Owing to the great freedom of motion possessed by the occipito-frontalis muscle, inflammation in this region, whatever may be its cause, very often assumes an erysipelatous character; hence it is necessary to keep a patient in a state of complete bodily rest, and free from all mental excitement. If there should be tension of the skin, indicating effusion beneath, a number of small incisions may be made, to permit of the exudation of serum or matter: this immediately relieves the distention, and seems to subdue the constitutional disturbance. In these affections, cold applications should be avoided, and warm fomentations and poultices alone employed. When, from fracture of the skull in this region, the employment of the trephine is necessary, the sutures should never be included within the operation of the instrument, particularly the sagittal suture, which marks the tract of the superior longitudinal sinus.

Wounds of the scalp are similar in their general character and appearance to those in other superficial parts, but they differ surgically in consequence of their proximity to the brain, and from the vessels of the scalp communicating with those of the interior of the cranium; so that, in wounds which seem at first but trifling, the inflammation may extend and produce serious ulterior consequences.

Wounds of the scalp may be divided into incised, lacerated, contused, and punctured. An incised wound of the scalp resembles precisely a similar wound in any other superficial part of the body. Generally the integuments are simply divided, and in that case the edges should be brought together by adhesive plaister, and bandage if it be required, and union by the first intention promoted. If the incised wound has taken a slanting direction, so that a flap is formed, it is more difficult to produce and maintain the coaptation of the parts; and in addition to the strapping a suture should be employed, and a double-headed roller applied over and around the skull, not only to assist in keeping the parts of the wound in the proper position, but to prevent all motion of the occipito-frontalis muscle. The patient should be kept perfectly quiet on low diet, and with the bowels freely open, and the surgeon should watch his condition closely, to detect the least tendency to cerebral symptoms, so that he may be prepared to combat them the moment they make their appearance. The application of the bandage is a measure of great importance, as it not only serves to keep the parts in the proper position, but by preserving them at rest it diminishes the tendency to erysipelas. It is better to avoid sutures, if possible, in wounds of the scalp, as they sometimes cause great irritation. When it becomes necessary to employ them, a very fine needle and small silk should be used, and the suture removed forty-eight hours after it is applied, or even sooner, if it produces more irritation than usual.

Lacerated wounds of the scalp may be produced by any instrument having a rough edge, which instead of dividing the parts tears them: these wounds may be complicated with contusion. When the wound is simply lacerated, the parts only being torn into a jagged wound, the treatment and conditions are the same as those that relate to other regions of the body, but they generally heal more readily, from the great vascularity of the scalp. The great object is to maintain the parts in apposition, and in a state of quietude. If a flap be raised from the cranium, as may happen in an injury inflicted by a hooked instrument, the case should be treated as incised flap wound, the same conditions holding in both instances with respect to the necessity for rest and careful adaptation of the parts. In *contused wounds* of the scalp, the principle of treatment is exactly the same as that in the treatment of ordinary contusions, when the parts are superficial, as on the shin; but in contused wounds of the head greater attention must be given to the antiphlogistic regimen, on account of the reasons I have before cited, viz., the proximity of the brain and its membranes. Wounds of this kind can never be made to heal entirely by the first intention. The wound should be cleansed, and the separated edges brought together and maintained in their proper position by plaister. The parts must not be nicely adapted, for some portions of the wounded integuments are often so much injured that sloughing will be sure to follow, and therefore it is wrong to attempt to promote adhesion by bringing them closely into contact; for if they are confined, the swelling will produce considerable inflammation and fever. When the edges of the wound are brought slightly together, warm-water dressing or poultice may be laid over the plaister, and the whole kept at rest, so that adhesion may take place in those parts of the wound which are in a condition to maintain the process of union by first intention. When there is a tendency to inflammation, calomel and opium, with small doses of tartarized antimony, may be given with advantage. The latter medicine is particularly useful, from the beneficial influence it exercises upon the action of the heart. If the contused wound be of the flap kind, the treatment must be somewhat modified: the flap must be carefully cleansed from gravel, or any other foreign matter, and should be immediately adapted to the denuded cranium, and kept in its place by adhesive plaister, bandage, and perhaps also by a suture. Some of the parts will probably slough, as in the cases already described, but a great portion will generally unite by adhesion: sometimes, however, the union by adhesion will not take place in any part of the wound, inflammation will set in, and matter be formed. This may burrow beneath the scalp, and possibly lead to exfoliation of the bones; but if the skull itself be uninjured, granulations will be thrown out, and the scalp re-united to the bone. When the matter is formed, openings should be made to admit of its escape, and the parts then kept in close contact by means of bandages. The constitutional treatment would of course be similar to that I have mentioned above, being chiefly directed to the suppression of the inflammation, and to the prevention of its extension to the brain.

Lacerated and contused injuries in the calvarian region are more likely to produce erysipelas than incised wounds, but the kind most likely to lead to troublesome consequences are those inflicted by a piercing instrument; that is to say, *punctured wounds.* Wounds of this description are often attended by the most urgent constitutional symptoms, indicative of high inflammatory fever. These symptoms are often so violent, when the occipito-frontalis muscle or its aponeurosis is punctured, that the life of the patient is placed in considerable danger. In punctured wounds, it is recommended by some surgeons to convert them at once into incised wounds, by freely playing them open. I do not think that this is advisable unless there be an excessive degree of inflammation. I should in the first instance prefer trying the effect of other treatment. I should keep the patient in a state of quietude, open his bowels, and confine him to a low diet for a few days. If the wound feels stiff or painful, it must be poulticed and fomented, especially avoiding cold applications; but if swelling should still supervene, attended by hot skin, white tongue, and thirst, with general pain, I should make an incision to liberate the effusions. At the same time, gentle antiphlogistic treatment must be adopted, the patient continuing to be kept as quiet as possible. If suppuration come on, the pus should be evacuated as soon as fluctuation becomes distinct. A bandage should then be applied around the scalp, to prevent the burrowing of the matter, and to keep the frontalis muscle at rest. I believe in most instances this treatment will be sufficient to prevent danger from a punctured wound in the scalp.

In the treatment of wounds of this region generally, it should be borne in mind that erysipelas and fever often follow upon them, and that from their proximity to the brain, unless proper measures be taken to prevent the membranes of the brain from becoming implicated, the most serious and alarming results may ensue.

Encysted tumours are of frequent occurrence in the calvarian region; I have known as many as twenty in one individual. They are readily removed by making an incision through the scalp, (being at the same time careful not to perforate the sac,) and, pressing the tumour at its sides, or rather in its immediate neighbourhood, it is usually ejected with great ease; but if the tumour has been subjected to pressure from the hat, or any other cause, it becomes adherent, and its removal is then attended with some difficulty. Although this operation appears to be a very simple one, it ought never to be performed without previous preparation of the patient; for if the tendon of the occipito-frontalis be wounded, and this sometimes cannot be avoided, its extreme mobility interferes so materially with the process of reparation, that abscess or erysipelas, and very severe general constitutional derangement, are often produced.

Emphysema may take place between the occipito-frontalis and the pericranium, in consequence of fracture into the frontal sinuses; in this case, should the entrance of air continue to a great extent, an opening must be made through the skin, so as to prevent its accumulation. It is seldom, if ever, necessary to tie the blood-vessels of this region after wounds, as their ramifications are extremely small, and lie closely upon the bone, so that mere pressure is generally sufficient to check the hæmorrhage. When abscesses form in this region of the body, they should be opened as soon as the presence of matter is evident; for if it be permitted to collect, it burrows, and separates the cellular membrane from the pericranium, the nutrition of which becomes impaired, and the dura mater and brain may at length be implicated. All this mischief may be prevented by early evacuation of the matter.

The temporal region.—In a surgical point of view the temporal artery forms the principal subject of consideration in this region, as it is here that that vessel must be opened for the purpose of abstracting blood, in case of violent inflammation of the brain or eye. The best mode of performing the operation is to carefully make an incision into the skin, so as to expose the artery, which must be raised from the aponeurosis of the temporal muscle by a probe passed beneath it, and then punctured by a lancet, as in venesection. When the necessary quantity of blood has been withdrawn, the artery is to be completely cut through by a probe-pointed bistoury, and the truncated extremities compressed by a dossil of lint, so as to prevent the recurrence of the bleeding. If the artery be not divided, but the compress merely applied over the puncture, an aneurismal tumour is very likely to be formed, rendering a surgical operation necessary for its cure. I have known very many instances in which this has occurred. The treatment consists in applying pressure on the temporal artery, both on the proximal and distal side of the aneurismal sac, which is to be laid open, and the coagulum turned out, after which both ends of the artery are to be secured by ligature.

External injury in the temporal region often produces abscesses, which excite considerable irritation, in consequence of the strength of the fascia by which they are surrounded. If they be not early evacuated, the matter forces its way under the zygomatic arch into the cheek, greatly aggravating all the previous symptoms. When the abscess has been opened, the patient should keep from moving the jaw, and take only such nourishment as will not require mastication,—so that the temporal muscle and its aponeuroses may be kept in a state of perfect rest.

The squamous portion of the temporal bone, owing to the depth of its position, and the protection it receives from the zygomatic arch, is not very liable to fracture from the direct application of external force, but it may be broken by a fall upon the vertex, or from the *contre-coup* in falling on the feet from a considerable height: the rupture of the middle meningeal artery of the dura mater is likely to attend the fracture of this portion of bone. The treatment in such cases I have already spoken of in describing fractures of the skull generally.

It is rarely necessary to apply the trephine in injuries to the temporal bone, but if the soft parts be sufficiently lacerated to expose comminuted bone, the exposed portions should be removed by forceps or Hey's saw.

In the operation of cupping in the temple, the branches of the temporal artery are sometimes partially divided : when this happens, the hæmorrhage which ensues can only be checked by completely dividing the wounded vessel.

Region of the ear.—The surgery of this organ may, perhaps, be considered, gentlemen, scarcely to come within our province ; but as most of you will probably be engaged in general practice, beyond the assistance of the professed aurist, it is quite necessary that you should at least be made acquainted with the nature of the accidents to which the ear is liable; as to the diseases of the internal structures, so intricate are they, and so delicate their organization, that the science of surgery can, I fear, be but of little avail towards producing their restoration, when once an abnormal condition is established. The diseases of the outer ear, or auricle, are, however, more easily treated, as they are readily detected, and admit of the immediate application of remedies. Congenital malformations sometimes produce defective hearing—as when the auricle is entirely wanting, or its form so unnatural as to render it incapable of concentrating and conducting sounds to the meatus auditorius. In the first instance, the meatus may also be deficient; if so, no remedy can be effectual; but if the meatus be only closed by skin, as is sometimes the case, it may be punctured, and hearing established, by the adaptation of acoustic instruments : where the auricle is only defective in form, the simple employment of an instrument will be sufficient.

The auditory canal is sometimes unnaturally constricted, so that the function of hearing is seriously interfered with. Sponge tent, and other methods of dilatation, have in such cases been proposed, but, as far as my experience goes, without producing any great advantage. The external meatus is also liable to obstruction, from the intrusion of foreign bodies. Children are particularly liable to this accident, as they put beads and similar matters into their ears, and these are often very difficult to remove : forceps, bent probes, and similar instruments are generally employed ; but I have always found an injection of tepid water, (by a strong syringe, with a long ivory nozzle), much more effectual : indurated wax may also be removed by the same means.

Polypi, although generally spoken of as arising from the meatus auditorius, more frequently originate in the cavity of the tympanum, and, after destroying the membrana tympani, protrude themselves into the meatus. Granulations which do, however, take their rise from the latter, often assume the character of polypi so closely, that the diagnosis between them is somewhat difficult. They may, however, be distinguished by desiring the patient, while compressing the nose, to make a strong effort to blow with the mouth closed. In case of polypus, air rushes through the ear, in consequence of the destruction of the membrane of the tympanum; while, in granulations of the meatus, this effect is not produced, as the membrana tympani remains intact. The treatment of polypi consists in their extraction by forceps, but owing to the delicacy of the structures involved in the disease, great gentleness must be observed in the manipulation. After their extraction, antiphlogistic and alterative remedies will be required. Granulations may be treated by mild injections of nitrate of silver or sulphate of zinc, taking care that the solutions are not strong enough to excite too high a degree of action in the inextensible tissue to which they are applied. The auricle may be injured by external force: it may, for instance, be torn, bitten, or cut off; by such an accident great deformity is produced, and the skill of the surgeon is called upon to restore the parts by a plastic operation.

Inflammation of the cavity of the tympanum is accompanied by intense pain, which affects the whole head, and frequently causes early delirium; strict antiphlogistic means should be immediately adopted, and general blood-letting or leeches, or even both, may be required; calomel with saline purgatives may also be administered. Should this treatment not prove effectual, matter may form, and the patient will not be relieved until it makes its escape through the membrana tympani; the discharge is ichorous, sometimes tinged with blood, and almost invariably produces a yellow or dark-coloured stain on a silver probe: fomentations, alteratives, and general soothing treatment should be adopted, and the greatest caution observed, even in the injection of tepid water; everything stimulating should be carefully avoided, as the sudden suppression of the discharge may produce inflammation of the membranes of the brain. Various instances have occurred in which fatal consequences have resulted from the employment of strong injections, and in these cases a post-mortem examination has shown pus to have been formed, either in the cerebellum, between the dura mater and temporal bone, or both.

Inflammation of the tympanum sometimes leads to the destruction of the ossicula auditus: this effect is indicated by fœtid discharge, attended by deafness. Such cases are to be treated by constitutional, rather than local remedies, and iodide of potassium, iodide of iron, or small doses of bichloride of mercury, are generally indicated; bark being employed as the vehicle.

Obstructions of the Eustachian tubes may arise from syphilitic ulcers, or any other cause which produces extensive inflammation of the membrane of the pharynx. When the tube is closed, air is prevented from passing into the cavity of the tympanum, so that the vibrations of its membrane are completely impeded. If the obstruction in the tube proceed from the cicatrix of an ulcer, it is irremediable; but if it be produced by congestion only, it may be cured by the usual antiphlogistic means. Sir Astley Cooper proposed, in case the obstruction arise from cicatrix, to puncture the membrane of the tympanum, to re-establish the equilibrium of the air; but this operation, although it produced a very good effect at the moment, did not prove permanently beneficial, as the opening reclosed in healing. It has also been proposed to perforate the mastoid cells, in order to admit air into the chamber of the tympanum in that direction, instead of through the membrane itself; more experience is, however, required on the subject of this operation before it can be recommended in practice. I should prefer Sir Astley Cooper's plan as the safer, if the operation be performed with caution, and the opening made quite at the lower part of the membrane, so as to avoid the manubrium of the malleus. Respecting the diseases of the labyrinth, the considerations are extremely limited; and I believe that surgical interference in such cases offers but little prospect of benefit to the patient.

Mastoidal region.—One of the chief surgical points connected with this region arises from the circumstance, that in abscess in the tympanum, the matter sometimes makes its way into the mastoidal cells, rendering it necessary that they should be punctured for its evacuation. This is the region usually selected for the application of blisters and setons in meningitis and inflammation of the ear; and it is frequently the seat of strumous ulceration, more particularly in children. The latter disease is easily cured by tonic alteratives, and by the application of mild mercurial ointment. Syphilitic exfoliations, or nodes, are not very unfrequent on the mastoid process of the temporal bone; and, indeed, I have myself witnessed such a result in a few instances. The true nature of these ulcers is only to be ascertained by their specific character, and by the history of the case. Probably the diagnosis will be assisted by the concomitant existence of sore throat, cutaneous eruption, and other venereal symptoms.

Base of the skull.—The surgery of this portion of the body is generally referable to fracture of the skull. Of this I have already treated, and then stated that fractures of the base could only be produced by "contre-coup." The inferior surface of the base of the skull may be divided into three distinct regions,—anterior, central, and posterior.

The anterior comprises all that portion in front of the pterygoid processes of the sphenoid bone, constituting the roof of the orbits and nose, and has been designated the "*ethmoido-frontal region*" of the base of the skull. Exostosis, or any other disease of the under surface of these bones, must affect the organs of vision and smell, producing in the former exophthalmia, and in the latter bony growths into the nose, which give rise to great deformity and obstruction to the olfactory sense. Similar affections on the upper surface of the same bones produce cerebral compression, with entire loss of vision and smell, without, however, any external visible signs, as in the former case. The ethmoid bone, owing to its division into cells (lined by mucous membrane), is liable to the formation of polypi, which sometimes protrude into the superior chambers of the nose. These polypi are occasionally of a malignant character, in which case they go on increasing, and ultimately destroy the life of the patient. Pus may be formed in the frontal or ethmoidal sinuses, whence it flows into the nose. The peculiar alteration in the voice marks distinctly the character of the affection.

The central division, or "*spheno-temporal region*" of the base of the cranium, is bounded by the pterygoid processes of the sphenoid bone in front, and the styloid processes of the temporal bone behind. Fractures in this region are invariably caused by "contre-coup," and are indicated by bleeding from the ear,—a symptom which will be easily understood when we reflect upon the close connexion between the base of the skull and the temporal bone. These fractures, without producing any distinct cerebral symptoms, frequently lead to the disturbance of some function carried on at a distance from the injured part; and as important nerves, especially the pneumogastric, pass out of the skull through foramina in this region, it is easy to comprehend how difficulty of swallowing and breathing, and interruption to the assimilative functions, may be produced by concussion, even without fracture.

Growths from the sphenoidal, as well as the ethmoidal cells, may protrude into the cavities of the nose, so as to interfere seriously with the functions of that organ. Exostosis in this part of the skull, or abscesses from carious bone, may produce violent dysphagia, rendering it necessary, in the case of abscess, that the pus should be immediately evacuated to relieve the symptoms. Any projections from the superior surface of this portion of the base of the skull, whether they arise from effusion of blood or morbid growths, must materially interfere with the function of the brain, by diminishing the capacity of the cranial cavity.

The posterior or occipital region consists of the whole of that portion of the base of the skull which extends behind the styloid processes of the temporal bone. In the centre of this region is situated the foramen magnum, through which passes the spinal marrow; and any fracture at this part must inevitably injure the spino-cerebral centre of the nervous system.

A diarthrodial joint connects the occiput and atlas at this region, forming an articulation in which anchylosis sometimes occurs; this must be regarded as one of the diseases of the region. The bone is here thickly covered by the extensor muscles of the head, and these muscles are often implicated in the disease peculiar to the region, so that the natural motions of the head on the spine are greatly impaired. The mobility of the parts renders it extremely difficult to keep them at rest when in a state of inflammation; hence arises danger in cases of carbuncle, erysipelas, or even ordinary wounds, in this region. When fractures interfere with the internal or cranial surface of this part of the base of the skull, danger is chiefly to be apprehended from effusion of blood, as upon the inner surface of the occipital and temporal bones all the cerebral sinuses converge to terminate in the lateral sinuses; and in case of their rupture, the effusion of blood would be so profuse as to occasion immediate death.

The advantages of an arbitrary division of the under part of the base of the skull may not, in a surgical point of view, at once appear evident; but when, in a physiological and anatomical sense, we consider that the various ganglia, or functional portions of the brain, have each their specific locality, it will be perceived that symptoms, manifested in some distant part, will enable us to judge with correctness as to the immediate seat of the injury to which the brain has been subjected.

The region of the face.—The face constitutes the anterior and lower part of the head, and includes the whole of that portion below the forehead and anterior to the central region of the base of the skull. The face is formed of the eyes, nose, and mouth, and their various appendages: these are organs of great importance, and as, owing to their situation, they are constantly exposed to the action of external influences, they frequently fall under the treatment of the surgeon. The nose, the organ of smell, is composed of two distinct parts: one osseous, constituting a portion of the skeleton; the other, consisting of skin and cartilage, moveable under the influence of muscles. The prominent form of the nose renders it extremely liable to injury from external violence. The fractures to which its bones are subject I have already spoken of; and I then mentioned that, owing to the proximity of the nose to the brain, the accident is not of such a trifling character as we may at first be led to expect.

The moveable or respiratory part of the nose is composed of skin, condensed cellular tissue, muscle, fibro-cartilage, cartilage, and lining mucous membrane. All these tissues are organized, and capable, therefore, of restorative action after lesion. The destruction of the moveable part of the nose by laceration or disease can only be remedied by plastic surgery. The making of a new nose is termed the Taliacotian operation, from the circumstance that an early surgeon, named Taliacotius, was the first to recommend its performance.

In this operation, the integument which is intended to form the new nose is generally obtained from the forehead, or, in the method known as the Italian, from the arm; there are, however, so many difficulties in the way of this operation, and, under all circumstances, success is so doubtful, that, excepting where the patient (after having been made fully aware of the probable fruitlessness, not to say danger) insists on submitting to it, the surgeon is scarcely justified in attempting an operation of the kind: besides, models are now made in Paris of some peculiar composition, and contrived so that they may be worn with a pair of spectacles; these imitate nature so closely, and are so skilfully adapted to the form of the parts, as almost to defy detection from a casual observer.

The skin of the nose is liable to the usual cutaneous eruptions, which are probably somewhat aggravated by the natural mobility of the part; it is also particularly disposed to that tubercular eruption termed lupus. I doubt, however, whether this disease does not take its rise in the fibro-cartilaginous tissues of the alæ, and not in the skin. Lupus is a most destructive disorder, but I do not consider it malignant; for if it be treated at its commencement, it is certainly sometimes curable. Iodide of iron, compound decoction of aloes, and sarsaparilla administered internally, with the local application of chloride of zinc, or the following paste—

℞ Crystal. acid. oxal. gr. x.
Pulv. opii, gr. ij.
Farina aquâ subacta, q. s.

This is to be applied in the same manner as the chloride of zinc, and I have found it much more effectual. Mr. Camps, of Fenny Stratford, first mentioned to me the escharotic action of the above compounds.

The mucous membrane of the nose is remarkably susceptible to inflammation, which constitutes the affection termed catarrh. This occasionally goes on to ulceration, which sometimes extends to the bones, interfering with their nutrition—an action which is soon indicated by the fœtid odour given off. This form of disease is known by the name of *ozæna.* Ozæna may easily be mistaken for syphilis; and, indeed, it is only from the history of the case that the diagnosis can be correctly formed. Ozæna may sometimes be cured by the use of iodide of potassium and general tonic remedies, and by the local application of sulphate of copper or zinc; while syphilitic sores yield only to the action of small alterative doses of mercury and mercurial fumigations. Ozæna is, however, a very obstinate disease, and often continues during the whole lifetime of the patient. Many different kinds of treatment have been tried, but without much success. The remarkable and fœtid odour is characteristic of the disease: it generally commences in childhood, or at the time of puberty, and in young girls it sometimes happens that the establishment of menstruation will cure the disorder. Cauterization of the mucous membrane with nitrate of silver has been proposed; and powdered alum, or calomel, has been found to produce good effects. One thing is, however, essential—great cleanliness. Injections of the chlorides, as disinfectants, may also be rationally employed with benefit.

Foreign bodies are frequently intruded into the nose, where they produce considerable irritation; and as they are drawn upwards into the olfactory chambers by the force of inspiration, their removal is sometimes attended by considerable difficulty. A bent probe or forceps is the best instrument for effecting the extraction of an extraneous body through the nostrils; but if it cannot be withdrawn in that direction, it may be pushed (by means of a pair of bent polypus forceps) back into the pharynx, whence it can be easily removed.

Polypi constitute one of the most distressing affections to which the nose is liable. They may originate in any of the mucous canals, and are found in the uterus, antrum, rectum, larynx, and meatus auditorius. In the present instance we have, however, only to treat of polypi of the nose. Polypi do not, as their name would indicate, spring from a great number of roots, but generally from one stalk only. They differ much in character; some being fleshy, and of a pale colour, while others are of a yellowish tint and gelatinous consistency, and are much less vascular than the fleshy kind. The gelatinous polypi usually take their rise in the mucous membrane covering the turbinated bones, and are rarely, if ever, attached to that of the septum narium. Polypi are sometimes highly dangerous, being of a cancerous or fungoid nature: these generally spring from the mucous membrane lining the antrum, or some other sinus opening into the cavities of the nose.

The subjects of this form of the disease manifest so distinctly cachectic diathesis, that the surgeon is led at once to form a most unfavourable prognosis; as no remedies, either local or constitutional, have yet been discovered capable of curing this complaint, any more than the other manifestations of malignant disease. The fleshy and gelatinous polypi, both of which are pendulous and of a jelly-like appearance, may be more or less protruded and drawn back in the actions of expiration and inspiration: they are not of a malignant character, and may therefore be abstracted by forceps, or removed by excision or ligature. Some surgeons attempt to destroy them by the application of caustic and astringent lotions; but I have never known the least benefit to be derived from this mode of treatment. In removing polypi by forceps, the patient must be placed in a chair opposite a strong light; and when the exact situation of the root of the polypus is ascertained by examination, a pair of "polypus forceps" must be introduced to a sufficient depth into the nose to grasp the root of the polypus, when, by gentle rotatory motion of the hand, its detachment may be effected, sometimes by merely tearing through its stalk, at others, by bringing away at the same time a portion of the pituitary membrane. If more than one polypus exists in the nostril, they ought all to be removed at the same sitting; but if there be a polypus in each nostril, it is better not to remove both on the same day, as inflammation of the brain may be induced; and, indeed, Sir Astley Cooper mentions a case in which death from this cause ensued, after the removal of a polypus from the nose: thus showing that proper precaution is necessary, even in this comparatively slight operation.

Polypi sometimes grow so far back in the posterior nares, as to pass but slightly into the nose, but project backwards into the pharynx, to some part of which they may be adherent. This condition is easily ascertained by examination of the soft palate, which, when a polypus is present, will be found so much depressed as to present a convex instead of a concave surface towards the mouth. Under these circumstances, it may be impossible to draw the polypi from the nose; but they may be seized by the forceps, as I have just described, and then pushed back through the posterior nares into the pharynx, where they may be taken hold of by another pair of forceps, and removed through the mouth. I have several times succeeded in removing large polypi whole by this operation, when I could only bring away small portions through the nose.

Some recommend excision in preference to the use of forceps in the removal of firm fleshy polypi, from the fear that the force necessary to detach them may injure the delicate turbinated bones. The excision is performed by a pair of long probe-pointed scissors: but the objection to the operation is, the greater liability to hæmorrhage when the bloodvessels are incised, than when they are torn through. Ligatures are sometimes preferred when the polypus seems highly vascular; but the difficulty in passing the silk round it, and the still greater difficulty in tightening it sufficiently to cut off the supply of blood, precludes the general use of ligature in polypus of the nose, although it is by far the best mode of removing them from the uterus, vagina, and other capacious canals. Operations for malignant polypi of the nose offer but little prospect of success, constitutional remedies being the only source from whence any benefit can be expected. In some cases, when the malignant growth projects from the antrum into the nose, the formidable operation of removing the upper jaw has been had recourse to, but with such doubtful success as almost to forbid the operation whenever the malignancy of the disease is established with certainty.

Epistaxis, or *hæmorrhage from the nose*, sometimes becomes so violent as to require surgical assistance to restrain it. This bleeding may either proceed from plethora or atony: its suppression may be mechanically effected by plugging the posterior nares with a pledget of lint, which is thus introduced:—A silk thread is fastened to the end of a catgut bougie, which is then passed through the nostrils into the pharynx, from whence the free end of the silk is withdrawn by the mouth; and, after fastening a piece of lint to it, the end of the thread left projecting from the nostril is drawn tight, and the lint becomes firmly impacted in the posterior nares. This is the most effectual means of stopping troublesome epistaxis; but I have known considerable difficulty arise in subsequently removing the plug of lint: sometimes, indeed, all attempts to push it back into the pharynx fail; and at the present time I am acquainted with a case, in which an individual has been compelled to submit for more than a year to this permanent nasal obstruction.

LECTURE XXXII.

CONTINUATION OF REGIONAL SURGERY.

Region of the Mouth — Structures entering into its composition — Diseases of the lips—Hare-lip—Operation—Cancer in lip—Symptoms — Peculiar to man—Modes of removal— Deficiency of the hard palate—Aphthous sores—Treatment —Syphilitic sores—Labial tumours—Epulis—Treatment—Diseases of the tongue — Hypertrophy—Treatment — Cases—Malformation — Cases—Ulcers—Cancer—Symptoms—Operations—Ranula — Case — Treatment—Region of the cheek— Wounds generally unimportant — Lesion of parotid duct — Caution in operations to avoid wounding it—Salivary fistula—Treatment— Wounds implicating the mouth—Treatment—Orbital region— Wounds of the eye—Amaurosis—Ptosis—Tic douloureux—Operation.

THE REGION OF THE MOUTH.

The mouth forms the commencement of the alimentary apparatus: it is also an organ of respiration and speech. Many different structures enter into the composition of the mouth, to fit it for the performance of its functions, and the injuries and diseases of these parts form an important subject for the study of the surgeon. The osseous portions of the mouth are composed of the superior maxillary and palatine bones, which form the hard palate or roof of the mouth, and the inferior maxillary bone, which constitutes its lower lateral walls. The thirty-two teeth also form a very considerable portion of its boundaries.

These osseous parietes are covered by soft parts made up of various tissues, comprising the lips, which are the anterior boundaries of the mouth; the cheeks, which circumscribe it laterally; and the fauces, which form its posterior limit. Besides these, it is bounded above by the hard and soft palates, which form the roof of the mouth; and below by the lower jaw and the muscles situated between it and the os hyoides.

Within the cavity of the mouth is placed the tongue and the terminations of the ducts of the salivary glands, the whole interior being lined by a mucous membrane. Of course the tissues which compose these organs are liable to lesions, similar to those which attack other parts. I shall describe them successively, and shall begin with the

Diseases of the lips.—One of the most frequent abnormal conditions of the lips requiring surgical attention, is the malformation termed *hare-lip.* This is often complicated with a congenital fissure through the hard and soft palates. Such cases are irreparable, and the skill of the surgeon can only effect some diminution of the deformity. The mere division in the lip (hare-lip never occurs in the lower lip) is not always in the mesian line; and there are sometimes two fissures, one on each side of the central projecting portion of the lip, which then assumes a lobulated character. This is called double hare-lip.

If the central portion projects to a great extent, it must be removed, and the lateral parts united by bringing together the pared edges; but if no abnormal projection of the central lobular piece of the lip exists, it may be preserved, and the sides of both fissures pared, the raw edges being brought together and held by twisted sutures.

Success in these operations depends upon the complete removal of the edges of the fissures, and the subsequent perfect adaptation of the excised surfaces, which are to be maintained in contact either by the uninterrupted or twisted suture, so that the effused adhesive matter may become organized by the perfect inosculation of the vessels from either side.

The best instrument that can be used in making the incision in this operation is the pointed bistoury, sometimes called a "phymosis knife." This must be thrust through the lip near its upper part, and close to the edge of the fissure, and, being drawn downwards towards its inferior edge, removes a continuous strip, or, in other words, the whole of the mucous edge of the fissure; the mucous membrane confining the lip to the gum should also be completely divided, as this facilitates the subsequent adaptation of the two surfaces. The operation must be repeated on the other side, and the parts then brought together, taking care that the line of the red mucous surface of the lip corresponds on either side of the incision, otherwise permanent disfiguration will be produced.

As the opinions of surgeons vary very much as to the proper period of life at which the operation for hare-lip ought to be performed, it is important that this debated point should be set at rest. For my own part, I agree entirely with Sir Astley Cooper in regarding it as unsafe to operate on infants before weaning: firstly, because, from their excessive irritability, they are totally unable to sustain any loss of blood; and, secondly, because after the operation they are incapable of sucking. Sir Astley has pointed out, in his lectures, the frequency of the failures he met with in his own practice in operating upon infants shortly after birth. I believe the best time, under ordinary circumstances, to be soon after the child is weaned, as it is then capable of receiving nourishment independently of its mother, and has overcome the distress incidental to the separation from her.

The operation can also be best performed at this age, because, at a more advanced period, as the development of the upper jaw increases in proportion to the growth of the teeth, the deformity is very much aggravated, particularly in case of complex hare-lip. In addition to this, children of five or six years old can offer resistance during the operation, and are also less patient under the restrictions necessary during the progress of cure.

The twisted suture is, I think, preferable to the interrupted; but the results of the practice of my colleague, Mr. Cock, seem to show that the uninterrupted suture is better than either.

The time for the removal of the sutures or pins must depend upon the extent of inflammation or tendency to ulceration; but I believe they are generally removed too soon after the operation. I have myself fallen into this error on more occasions than one.

In double hare-lip, the first question that presents itself is, whether the central portion ought or ought not to be removed. This depends not only upon the size of the part, but also upon the extent of malformation in the upper jaw itself, as there frequently exists a distinct inter-maxillary bone containing the two front incisor teeth. Under this form of the disease, not only must the central portion of the lip be removed, but the incisor teeth must be drawn, and their alveolar processes removed by the "bone forceps." The operation may then be completed as in single hare-lip. When it is decided that the central portion is to be left, the following mode of procedure must be adopted:—The mucous membrane attaching it to the gum is to be divided, and the free extremity being seized by a pair of forceps, the sides of the lobe, and the parts of the lip which form the corresponding sides of the fissure, are to be pared, and then brought and maintained in contact as in the operation for single hare-lip, already described.

In double hare-lip, when the central portion is not removed, it is a question whether the two sides should be operated on at the same time. This depends, in my opinion, upon the condition of this middle portion, as to its fitness to support the double demand upon its vital powers. In these operations the labial arteries do not require ligature, even though the bleeding may be somewhat profuse, as the hæmorrhage will be immediately stopped upon the application of the sutures.

Cancer of the lip.—As hare-lip has always its seat in the upper, so it is remarkable that cancer attacks almost exclusively the lower lip. Sir Astley Cooper states that he had seen upwards of two hundred cases, in only one of which the upper lip was the seat of the disease. Cancer of the lip commences with a small ulcerated fissure or crack, with hardened and everted edges, or sometimes as a warty excrescence, on one side of the mesian line. It generally attacks men after middle age, females being little liable to the complaint. I have, indeed, never seen a case in a female. The character of the sore is very peculiar, from the hardness and eversion of its edges. If the surgeon be applied to at the early stage of the disorder, chloride of zinc may be employed to destroy the diseased parts; but if the ulcerated surface be extensive, excision by the knife is preferable. The operation of excision should never be proposed when the disease has extended to the glands under the jaw, especially if the skin covering these swellings has assumed a livid appearance, which threatens ulceration, and indicates the malignant character of the disease. If, however, one small isolated gland only be enlarged, and the patient's health seem but little impaired, it is probable that the swelling of the gland merely arises from irritation, and not from a specific action. Under these circumstances, the operation may still be justifiable. I am doubtful whether this disease can in its first stage be considered as truly malignant; if such were the case, it is surprising that females should not be subject to it, and also that the upper and lower lip should not be equally prone to contamination in a malignant diathesis. Moreover, I have known the disease perfectly cured, when removed at its commencement, either by excision, or by escharotics, such as the chloride of zinc. I am therefore disposed to believe, that, owing to the extreme mobility of the lower lip in case of ulceration, the attempts of nature at reparation being continually interfered with, an irreparable sore is produced; and, from the irritation excited by the interruptions to the healing process in some diatheses, a malignant tendency may be developed; so that the sooner the disease be removed, and the more complete the state of rest in which the lip is kept, the greater the chance of a permanent cure.

When excision is chosen for the removal of the complaint, there are two modes of executing the operation: one, by including a portion of the lip in the part to be excised, so as to ensure the removal of the whole of the affected structures, the removed part being in the form of the letter V; the other consisting in the mere removal of the diseased portion by cutting immediately round it in a semi-circular direction. I prefer the latter if the disease be limited, as the granulations fill up the incised space, and cause less deformity than when the first operation is adopted. In the former operation, as in that for hare-lip, the labial arteries do not require ligature, as the sutures will be quite sufficient to stop the hæmorrhage.

Deficiency of the hard palate.—In this malformation the power of the surgeon to afford relief is very limited, both with respect to the unpleasant nasal character of the voice, and to the prevention of the passage of the food into the nose. Mechanical contrivances are the only available means of treatment, and so many of these inventions are in existence, that it is almost impossible to know which is to be preferred. Plastic operations are sometimes performed for the cure of this defect, but I do not place much confidence in them. In fissure of the soft palate, however, an operation similar to that for hare-lip often proves quite successful.

Aphthous sores form sometimes on the internal or mucous surface of the lips; these are very painful, and difficult of cure, unless constitutional means be adopted to improve the assimilative functions, from the derangement of which they most frequently arise. I generally employ the following mixture—

℞ Ammon. sesquicarb. ʒss.
Sodæ sesquicarb. ʒiss.
Pulvis. rhei, ℈ij.
Tinct. card. co. ℥ss.
Inf. gentian co. ℥viiss. M.
Capt. coch. larg. ij. bis quotid.

If, after taking this medicine a few days, the sores do not show a disposition to heal, nitric acid or nitrate of silver must be applied to the part: this will generally be found to produce the desired effect. I have met with syphilitic sores on the lips which could not be cured by alterative doses of mercury; and I have had some difficulty in determining whether they proceeded from a primary or secondary affection: it is certainly difficult to understand how inoculation could occur in such a part; but the appearance of the sore was, in some cases, such as almost to preclude doubt; and it yielded only to the treatment employed for the cure of primary sores under ordinary circumstances. Small tumours are sometimes found under the mucous membrane of the lips and cheeks, but they are of no importance beyond the inconvenience they occasion in mastication, and in the general motions of the lips; they appear to arise from enlargement of the labial and buccal glands; they frequently resist every means employed for their dispersion, and, in one or two cases, I have been obliged to extirpate them by the knife.

Epulis is usually considered a disease of the gum only, but it is generally the consequence of disease of the teeth, or alveolar process of the jaw. At first, a projecting tumour is formed between two of the teeth only, but if it be not removed it will increase rapidly in size, and soon involve several others. The tumour has a malignant appearance, but if proper means for its removal be adopted, the danger is not by any means commensurate with its threatening aspect. The implicated teeth must be removed, and an incision being made through the gum, on either side of the tumour, the whole of the diseased part, with the alveolar process of the teeth involved in the mischief, must be taken away by a pair of *bone scissors.* I have attempted to cure epulis by merely removing the diseased soft parts and teeth, but I have always found that the complaint returned, unless the alveolar processes were removed with the other parts.

Diseases of the tongue.—In speaking of these I shall commence with *hypertrophy,* or extraordinary growth of the tongue; this has been met with by many surgeons. Mr. Hodgson, of Birmingham, has given a good account of its successful treatment by its removal with ligature. In this operation, a needle, armed with a double thread, is passed through the substance of the tongue in the mesian line, and posterior to the part which projects beyond the teeth; the threads are then separated, and tied as tightly as possible on each side; a double ligature is thus formed, and after a time the whole of the excluded portion of the organ sloughs off.

A case of hypertrophy of the tongue is recorded by Mr. Webster, of St. Alban's. It occurred to a farmer in that neighbourhood, who, having put himself in a violent passion with one of his men, was shortly afterwards seized with an excruciating pain in the left side of his tongue, which soon began to swell, and in half an hour had acquired so great a size as to interfere with respiration. Mr. Webster was sent for; on his arrival he found the patient in great pain, and with his tongue protruding from his mouth. An attempt was made to squeeze the blood out of the tongue, but unsuccessfully, and an incision was made in it; this was followed by a profuse hæmorrhage, which produced some diminution in the size of the organ, and relieved to a considerable degree the difficulty of breathing. A few hours after he had left his patient, Mr. Webster was, however, again summoned, when he found that the swelling had recurred to a greater extent than before, and now, indeed, threatened instant suffocation. Mr. Coles was called in consultation, and it was agreed that more extensive and deeper scarifications should be made; immense hæmorrhage followed—so much so, that the medical attendants began to be apprehensive of the consequences, the patient being eighty-four years of age. The swelling in the tongue began, however, immediately to subside, and this continued until the part was restored to its natural size. A large dose of opium was given as soon as the bleeding had stopped; and, notwithstanding his great age, under the use of tonics the health of the patient was speedily re-established, and he has never had any return of the disease.

Mr. G. Humphrey, one of the surgeons to the Cambridge Hospital, lately removed a permanently hypertrophied tongue in a case where it protruded from the mouth, and materially interfered with speech and deglutition. The removal of the tongue was effected by excision, preparatory ligatures being applied so as to suppress hæmorrhage, in case there should be any difficulty in taking up the arteries individually.

I have met with a curious, and I believe very rare, malformation of the tongue, which was still more remarkable, as two children of the same family were the subjects of the defect. A Mrs. Dunn, of Cursitor-street, Chancery-lane, brought me her baby, whom she said "swallowed her tongue;" so that she was often in great danger of suffocation; the mother was the more alarmed at this, as a few months before she had lost a child a year and a half old from a similar cause. On examination of the mouth no tongue was visible, but the fauces seemed filled by a fleshy tumour. The exertion of crying, however, immediately brought the tongue into its natural position; and when I closely examined it I found that there existed no frænum to attach it to the floor of the mouth, but it was only confined to the pillars of the fauces by the reflexion of the mucous membrane. The mother of the child informed me that, when sleeping, its breathing was particularly impeded by the position which the tongue assumed; but that, when sucking, the muscles seemed capable of retaining that organ in its proper situation.

Ulcers frequently occur on the tongue, and when situated on its edge become irritated by contact with the teeth, and are sometimes extremely difficult to cure. In such cases extraction of the teeth is recommended, but I believe that strict attention to the state of the stomach and bowels, and the employment of iodide of iron and arsenic, (or if there be any trace of syphilitic taint, small doses of mercury,) will generally be found sufficient to remove the disease.

Nitrate of silver, or nitric acid, may also be found beneficial as a local application.

Cancer of the tongue.—This is not an infrequent disease; I have myself met with several instances of it. It generally makes its appearance at an earlier period of life than that at which malignant affections develop themselves in other parts. Cancer of the tongue commences with an induration, which soon ulcerates, and becomes surrounded by a substance almost as hard as cartilage; the edges of the wound are everted, and its surface foul and of a dingy red colour; the pain experienced is very acute, and of the lancinating character peculiar to cancer; it extends in the course of the three divisions of the fifth pair of nerves. If the disease be not removed, the ulceration will continue until some large artery is implicated, and then a hæmorrhage will ensue that can only be checked by the actual cautery.

Although the hopes held forth by operation in this complaint are but slight, it offers the only chance of saving the life of the patient. The disease may be removed by excision or by ligature. I have on four occasions extirpated the diseased portions of cancerous tongue by ligature, applied so as to completely include the affected parts, which were of course ultimately removed by sloughing. None of these cases were, however, successful: the lymphatic glands under the jaw sooner or later became involved in the disease, and in no case did the patient survive more than two years after the operation.

The immediate cause of death may be either hæmorrhage or suffocation, resulting from the propagation of the disease to the root of the tongue and the tissues forming the glottis. When hæmorrhage occurs, the actual cautery should be applied, and should that fail, the lingual artery should be tied; but when suffocation is threatened, opening the trachea sufficient to avert the immediate destruction of the patient.

In addition to the diseases proper to the tongue, the condition of the mucous surface of that organ is a matter of importance in diseases in which its mucous membrane merely sympathizes with the general disorder: it is necessary that the medical practitioner should make himself well acquainted with these changes, as indicative of disordered functions of the stomach or other organs, as perhaps there is no one symptom more generally useful in the formation of diagnosis in relation to constitutional disturbances.

Ranula.—A large semi-transparent tumour sometimes forms under the tongue, pressing it so far backwards as partially to close the glottis, and consequently interfere materially with respiration.

This swelling is occasioned by the obstruction of one of the salivary ducts leading either from the submaxillary or sublingual glands; the disease is termed ranula. Mr. Cline, one day in his morning practice, was somewhat startled by hearing a heavy fall in the room in which his patients waited. He immediately went to see what had happened, and found a gentleman on the floor, struggling in a paroxysm of asphyxia. Mr. Cline opened the mouth of the patient to seek for the cause of these symptoms, and detected at a glance the presence of a large ranula; he plunged a lancet into the tumour, thus affording means of exit for the saliva, and the individual was at once restored from his critical position. Merely opening the sac must, however, be regarded only as a remedy of the moment, for the sides of the duct would very soon re-unite and the disease return, unless, indeed, a salivary calculus were the cause of the obstruction; in that case its removal would produce a permanent cure. I usually adopt the seton as the most efficient means of curing this disease; and in one or two obstinate cases I have placed a piece of gum catheter in the wound, so as to prevent the accumulation of the saliva, and induce the obliteration of the sac.

Region of the cheek.—Owing to the extensive and prominent surface presented by the cheeks, they are very liable to be injured by external force; their wounds are not, however, of a very serious character, as the blood-vessels which supply the various tissues are comparatively small, and easily secured, so that the hæmorrhage is not so important as in many other parts of the body. Wound of the parotid duct is one of the most serious injuries that can happen in the region of the cheek, and care must be taken to produce re-union as quickly as possible, otherwise a salivary fistula may be formed, which would prove extremely difficult to cure. The exact situation of the parotid duct should be carefully considered in the extirpation of tumours in the cheek, or it is not unlikely that the duct may be injured during the operation. This danger may, however, be avoided by remembering that the duct is placed in a line running from the inferior extremity of the lobe of the ear to the corner of the mouth; but when it is necessary to perform an operation in this part, it is a good plan to expose the duct before attempting to remove the tumour. I once removed a tumour lying on the parotid gland, for a gentleman of Wells, in Norfolk, and, in the course of the operation, injured the gland itself, or one of the small ducts which lead from it, to form Stenon's duct; a salivary fistula formed, but it was ultimately cured by the red oxide of mercury, after nitrate of silver and other applications had failed.

If the salivary duct should be wounded during any of the operations upon the cheek, or from any accident, the best way to prevent a fistulous opening, is to keep the patient from using the jaw in mastication; this may be done by feeding him upon such food as requires only simple deglutition; but should a permanent salivary fistula have become established, and the duct be only partially divided, a needle, armed with silk, is to be passed into the abnormal opening, and through the duct into the mouth. A knot is tied in the end of the silk outside the cheek, and this is drawn up tightly against the side of the duct, and the silk fastened so as to preserve a continued tension; by this means ulceration will be set up, and an opening formed for the flow of the saliva into the mouth, after which the external wound will soon heal. The only point of difficulty in this operation is the preservation of continued pressure sufficient to produce ulceration; the tension of the ligature is sometimes maintained by fastening it to the teeth, and at others by bringing the thread out of the corner of the mouth and fixing it by a piece of plaister. If the duct be perfectly divided, so that two truncated extremities are left, some surgeons have considered it necessary to treat both in the manner I have just described, but for my own part I cannot see why it should be requisite to pay attention to the distal termination, as it can receive no saliva, and therefore cannot tend to keep up the fistulous character of the original opening.

Wounds of the cheek, especially from burns, sometimes cause a diminution in the size of the external opening of the mouth, owing to the contraction of the cicatrix; great deformity is thus produced, and the only plan by which relief can be afforded, is by an operation for the removal of the cicatrix, leaving at the same time the mucous membrane of the cheek entire, so that, after being divided to a sufficient extent, it may be turned over on each side of the incision to form a mucous surface, which will completely prevent adhesion: the mouth may thus be restored very nearly to its natural form.

Large tumours are not unfrequently found in the cheek; and in some cases there is great difficulty in determining to which structure the tumour appertains. A lady was sent to me from Wangford, in Suffolk, who was suffering from a fluctuating tumour, situated just below the zygomatic prominence of the cheek: the tumour had twice been opened by puncture from within the mouth, and each time a large quantity of glairy, transparent fluid, was evacuated. It had now regained its former size, and it became a question as to what means could be adopted to destroy the secreting power of the sac. As I could not detect any communication with the antrum, I recommended that a seton consisting of three or four threads of silk should be passed from the mouth through the sac, and allowed to remain there until the inflammation was considered sufficient to have produced the desired effect. Two of the molar teeth had been drawn, and the cavity of the antrum was opened, but no fluid flowing from the latter, there was every reason to believe that it was not implicated in the disease. The seton was allowed to remain in the tumour about three weeks, and the cyst became completely and permanently obliterated.

The tonsils are subject to many affections that require surgical treatment. The most common of these is chronic enlargement, which sometimes goes on to so great an extent as to interfere materially with breathing, speech, and deglutition. This condition is most frequent in young people of strumous diathesis; and constitutional treatment consistent with such a tendency will generally be found sufficient to relieve the local affection—at least, constitutional remedies should always be tried before a surgical operation is performed, although in such cases it too frequently happens that the effect is treated without due attention being paid to the cause.

Extirpation of the indurated glands is, however, sometimes necessary: the best mode of removing them is to seize the tumour by a pair of hooked forceps, draw it out from between the pillars of the fauces, and then excise it by means of a probe-pointed bistoury.

Various complicated instruments have been invented to effect the above operation, but the plan I have described is at once most simple and effectual.

In *abscess* of the tonsil, some care should be taken, in evacuating the pus, not to plunge the lancet too deeply, but merely to puncture the wall of the abscess, as there is danger of wounding the internal carotid artery; and, indeed, a large opening is not necessary, as the pillars of the fauces exercise a controllable force quite sufficient to complete the evacuation of the matter.

The tonsils are often the seat of ulcers, which are sometimes syphilitic. We must not, however, decide too hastily in such cases, but first endeavour to gather from their history whether there be just reason to suppose that venereal taint positively exists—a circumstance often taken for granted without the proper inquiries having been made. When this ulceration is the result of constitutional deterioration, produced by an over-use of mercury; iodide of potassium, or iodide of iron, will generally be found an effectual remedy.

Orbital region.—The wounds of this region, although generally unimportant, sometimes assume a very serious aspect; amaurosis, indeed, frequently results from severe injury to this part. It is by some supposed that this effect is produced by lesion of the supra-orbital branch of the fifth pair of nerves. I cannot, however, comprehend how an injury to a nerve of common sensation can affect one of a special sense; I believe that when amaurosis follows such an accident, it arises from the direct concussion of the optic nerve. Some months ago I saw such a case with Mr. Dalrymple. A gentleman had been knocked down by a cab, and irrecoverably lost his sight in consequence of a blow on the orbit, although the skin over the part retained its natural sensibility, and no cerebral disturbance was evident; so it appeared that the injury inflicted was to the optic nerve or retina, and not to the supra-orbital branch of the fifth pair of nerves.

The supra-orbital nerve is sometimes morbidly sensitive—a condition which is known under the term "tic douloureux," or "brow ague;" the latter name is given to it when it assumes an intermittent character; and this form of the disease can generally be cured by quinine or arsenic, with the external application to the brow of an ointment composed of a grain of aconita, and a drachm of spermaceti ointment.

In the continuous form of "tic douloureux," the division of the affected nerve is sometimes tried; but, although this treatment affords relief at the moment, it is seldom of any permanent benefit.

Some years ago I was consulted by a stock-broker, at Brixton, who was a sufferer from this painful malady. He suffered such extreme agony during the paroxysms, that he was sometimes totally unable to control himself. In this case I divided the nerve, and the patient was completely cured.

In dividing the supra-orbital nerve, a small incision must be made beneath the eyebrow, immediately below the supra-orbital foramen, which is placed at the junction of the inner with the two outer thirds of the arch of the brow; and then, inserting a sharp-pointed bistoury under the skin, the nerve must be divided by what is termed the subcutaneous operation, as it issues from the foramen.

A serious disease, in connexion with the region of the eye, is lachrymal tumour and fistula. The tumour consists in a distention of the lachrymal sac, and fistula is produced when the walls of the sac become perforated. The most frequent causes of lachrymal tumour are inflammation and irritation of the lachrymal sac; but the disorder does not always take its origin in the sac itself, and may arise in consequence of mechanical obstructions of the duct, or from extension of inflammation from other structures following small-pox, scarlatina, scrofulous affections, or syphilis; the disorder may also arise in consequence of congenital malformation of the parts, or from accidents which destroy the normal relation of the bones. This disease is generally very slow in its progress, the growth of the tumour being almost insensible; it is circumscribed, without pain or change of colour of the skin; it is much under the influence of change of temperature and rest; it is diminished under circumstances which tend to keep the parts tranquil and to lessen the secretion of tears, and is increased by every thing which stimulates the eye, such as excessive strong light and cold in the early stages; it contains a fluid which scarcely differs from the tears; but as it advances, this fluid becomes muco-purulent, and afterwards true pus. In a later stage the tumour is increased in size, is less circumscribed, the skin becomes red or brownish, and there is acute pain; at length the ulceration reaches the skin; there appears on the tumour a small white spot, which bursts, and fistula lachrymalis is established. Sometimes, instead of bursting externally, the tumour may empty itself upon the mucous membrane, the lachrymal bone may be softened and ulcerated, and permit the contents of the abscess to be discharged through the nose, thus forming a kind of internal fistula, which may be regarded as nature's process of cure. In the treatment of lachrymal tumour, it must be remembered that the origin of the disorder is inflammation of the sac or duct, either commencing idiopathically, or extending from other inflamed structures; antiphlogistic treatment must therefore be adopted, at least at first, leeches applied to the part, general bleeding, and cold or tepid lotions; but the treatment must, of course, be modified according to the origin of the disease, that is to say, as to whether it can be traced to any constitutional disorder, as syphilis or scrofula. In the treatment of fistula lachrymalis by operation, the following process is generally adopted; it consists in the introduction of a canula of silver or gold, which is intended to remain permanently in the opening until the cure is effected. To introduce the canula, an incision is made into the lachrymal sac by means of a bistoury; in this incision the canula is inserted, taking care that its extremity enters the sac and does not merely remain within the wound. Much has been said both for and against the use of the canula: its opponents have traced to it many serious evils following the operation, but most of these are probably attributable to want of skill and experience on the part of the operator. Cauterization has also been proposed as a cure of fistula lachrymalis: it is said that potassa fusa is the best escharotic to be employed. Some surgeons recommend the introduction of a bent probe into the nasal duct, from the inferior chamber of the nose, for the purpose of overcoming stricture of its membrane; and in some few cases where stricture has been the cause of the fistula, this treatment has proved successful.

LECTURE XXXIII.

CONTINUATION OF THE ORBITAL REGION.

Diseases of the eyelids—Tissues entering into their composition—Suppuration in the eyelids—Obstruction of punctum lachrymale—Ecchymosis—Treatment—Entropium—Its effect—Ectropium—Operations—Hordeola or styes—Encysted tarsal tumours—Treatment—Wounds of the eyeball—Treatment—Intrusion of foreign bodies—Mode of removal.

Diseases of the jaws—Osteo-sarcoma of the jaw—malignant character—Extirpation—Tumours from the antrum and upper jaw—Case.

Region of the neck—Anatomical relations—The pharyngeal region—Its limits—The pharynx subject to the lodgment of foreign bodies—Their extraction—Opening the trachea—Abscesses—Case—Ulcers in the pharynx—Anterior region of the neck—Definition—Supra-hyoideal region—"Cut throat"—Treatment—Tumours—Laryngo-pharyngeal region—Wound of lingual artery—Case.

Diseases of the eyelids.—Before we begin to treat of the diseases of the eyelids, it is proper to give some consideration to the various structures which enter into their composition, as it is evident that the eyelids must be liable to the diseases incident to each of their tissues: these are, skin, cellular membrane, muscular fibre, tendon, fibro-cartilage, mucous membrane, and the cilia.

The skin of the eyelids is subject to the eruptions common to the integuments of the other parts of the body; and there is nothing peculiar to it beyond what may arise from its extreme tenuity.

The cellular membrane is remarkable for the freedom of the connexion between its cells. The muscular apparatus of the eyelid, in common with the muscular system of other parts of the body, is subject to no other disease than that arising from morbid irritability, producing a constant twitching or "winking" of the eyelids. The tendon of the levator palpebræ, which is inserted into the fibro-cartilage, constituting the tarsus, is, like all tendinous tissues, as well as the fibro-cartilage into which it is inserted, from its low vitality, readily disposed to slough under a very slight degree of inflammation. When the tarsus becomes affected it frequently leads to great interference with the functions of the lid. The mucous membrane of the eyelids is also liable to the peculiar diseases of this tissue, such as ophthalmia, &c. The structures connected with the hairs of the cilia sometimes become diseased, and this also constitutes one of the morbid conditions to which the eyelids are liable.

Suppuration of the eyelids.—Owing to the looseness of the cellular membrane of the eyelids, they are very liable to suppurate under inflammation; and as this affection causes great swelling, and interferes with the motion of the upper lid, it is necessary that the matter should be early evacuated; and as the disorder usually attacks persons of a weak, strumous habit, tonic medicines will be requisite. In erysipelas, such abscesses often occur, and unless the matter is let out, sloughing very soon results. In evacuating the matter the incisions should be curved, following the direction of the fibres of the orbicularis palpebræ muscle, so that the cicatrix may be hidden in the natural folds of the skin of the eyelid, and the deformity avoided that would result if the incision were at right angles to the muscular fibre. Small circumscribed tumours frequently obstruct the punctum lachrymale, so as to cause a flowing of tears over the cheek. This may be mistaken for fistula lachrymalis; but the comparatively slight pain in palpebral abscess, and the great inconvenience attendant upon inflammation of the lachrymal sac, constitute the diagnostic distinction between them. In opening the abscess, great care must be taken not to injure the punctum lachrymale, as permanent disease would result from its obliteration.

Ecchymosis.—Extravasation of blood into the eyelids, technically termed ecchymosis, frequently results from external injury. The removal of this coagulum by incision should never be attempted, as a few leeches, and poultices composed of the bryony root, scraped and mixed with bread, will be generally found sufficient to the purpose.

I am of opinion that, in all cases of ecchymosis, more injury is done by the incision to remove the coagulum than by the presence of the blood itself. A spontaneous ecchymosis, or effusion of blood into the eyelids, sometimes occurs, and is characteristic of great constitutional deterioration, especially of an impoverished condition of the blood. This appearance must always create considerable alarm; and the treatment required is similar to that necessary in the hæmorrhagic tendencies; such as acids, bark, and generous diet.

Entropium or inversion, and *Ectropium* or eversion, of the eyelids, not unfrequently result either from disease or injury to these organs, particularly to their fibro-cartilaginous portions.

In entropium, the free edge of one or both of the eyelids is turned inwards upon the globe of the eye, with the surface of which the eyelashes are brought in contact. Violent inflammation results, the transparency of certain parts of the organ becomes impaired from a deposition of lymph, large bloodvessels from the conjunctiva shoot across the cornea, ulceration of the latter membrane soon follows, and the eye will perish unless the disease be cured.

Entropium is not always a permanent disease; it is sometimes produced only as a consequence of some acute abnormal condition, and will pass away with the cause from which it arose. When it arises, however, from the formation of cicatrices, or from destruction of the tarsus, it will of course remain permanent.

Ectropium, or eversion of the eyelid, produces at first much less suffering, as in this case the conjunctival surface of the eye is not subjected to the irritative action of the cilia. The relaxation of the parts which occurs in age is a very frequent cause of ectropium; in this case there is likewise weakness, and sometimes paralysis, of the orbicularis muscle: it may also depend upon loss of part of the skin from a wound or burn, when the lid would, of course, be everted by the contraction of the cicatrices. If the disease be allowed to remain, the tunica conjunctiva of the eyeball being unprotected by the lid, and losing the beneficial lubricating influence of the tears, soon becomes inflamed, from the action of the air, and by the lodgment of extraneous particles of matter; the inflammation proceeds to opacity of the cornea, and ultimately to the destruction of vision. The deformity in this disease is even greater than in entropium: in consequence of the large inflamed mucous surface exposed to view, the cornea ulcerates, the anterior chamber of the eye is laid open, the aqueous humour escapes, and the organ is very soon completely destroyed. The inferior lid is most frequently the seat of this affection.

These diseases may occur from an altered condition of the tunica conjunctiva, of the skin of the eyelid, or from disease of the fibro-cartilage which constitutes the tarsus. Entropium sometimes results from a relaxed state of the skin of the eyelid, with the exception of that at the ciliary edge, so that there exists an unequal degree of resistance to the orbicular muscle of the eyelids, and a tendency to inversion is established. The deformity arising from this cause may be cured by taking up a fold of the loose skin, and cutting out a longitudinal slip, after which the excised edges must be perfectly adapted, and kept together by the uninterrupted suture, the contraction of the cicatrix removing the inversion. Some surgeons have recommended that the skin should be removed by strong sulphuric acid, but I consider the excision of a portion of the integument far preferable. When disease of the tarsus causes either entropium or ectropium, a portion of that structure must be removed; this is best effected by passing a needle, armed with silk, through the ciliary edge of the lid, so as to give perfect command of this moveable part. A triangular portion of the lid is now to be excised, and the incised edges adapted by suture. The surgeon is able to judge of the quantity which it is desirable to remove, by examining the relation of the lid to the globe of the eye before he operates. When thickening of the conjunctiva produces ectropium, or a cicatrix in it, entropium, the operative means must be applied to this membrane.

Tumours of the palpebræ frequently interfere both with the motions of the eyelid and with the state of the conjunctival surface of the eyeball: the most common of these are hordeola, or "styes," which require little or no further treatment than the application of cold, or a poultice. Sometimes, however, the matter will not make its escape by the process of ulceration, when a small opening should be made, the pus evacuated, and nitrate of silver applied to the wound.

Encysted tarsal tumours also often produce considerable inconvenience: the tumour seems as if it were placed between the skin and the outer surface of the tarsus; but if their extirpation be thought necessary, they should be removed from the inner side by everting the lid: usually, however, merely puncturing the sac, and passing a small probe into its interior to break it down, will be sufficient to cure it. Such is the operation usually recommended. I have, however, frequently removed them in the following manner: everting the lid, removing a portion of the mucous membrane covering the tumour, and, with a pair of bent-bladed scissors laid flat on the tarsus, cut off the whole tumour.

In cases where portions of the eyelids are lost, either from ulceration or wounds, plastic operations for the purpose of forming or restoring a covering to the eyeball, are sometimes had recourse to. These operations are likewise sometimes adopted when there is congenital deformity: the principle is precisely similar to that of the Taliacotian operation for the new nose; healthy integument being brought from the immediate neighbourhood of the part, and laid down upon the freshly incised surface, where it must be maintained in close adaptation until union takes place. This operation appears, I think, to be generally more successful than that for new nose. In wounds of the eyelids the conditions and treatment resemble those in other parts: when the wounds are simply incised they usually unite without difficulty, and, indeed, even when contused, unless very severe, they are not difficult to heal; but here, as in wounds of the scalp, if the deep tissues of the orbit become affected, the proximity of the brain must always influence the nature of the case, as instances have been known in which brain symptoms and death have followed upon an apparently trifling wound in the eyelid.

In *wounds* of the eyeball, the danger accruing depends upon the extent and depth of the lesion. The first great object in such an accident, is to subdue the inflammation by strict antiphlogistic treatment, and opening the temporal artery should almost always be had recourse to; for, if the inflammation be allowed to pass into a chronic state, instead of being completely subdued at first, the delicate tissues of the eye are almost certain to become implicated, and the power of vision be either wholly lost or permanently injured. It is hardly necessary to mention that the patient should be kept in darkness, under the influence of mercury, upon low diet, and the bowels freely acted upon during the progress of the cure.

Foreign bodies are often intruded into the eye; they are, however, easily removed by everting the upper lid, by turning it over a probe pressed just above the tarsus; nearly the whole of the conjunctival surface may be thus exposed, and any small particles easily removed with the corner of a cambric handkerchief; if, however, a particle of iron, or such-like substance, should become imbedded in the cornea, it must be removed by a "couching needle;" cold lotions, or leeches, may afterwards be required to subdue inflammation.

Diseases of the jaws.—As the jaws are subject to disease which sometimes renders their removal necessary, they occupy a prominent and highly important position in the surgery of the region of the face.

Perhaps there is no part of the skeleton more frequently diseased than the lower jaw. Many different kinds of tumours are found in this region, all of them of greater or less importance, and some of a character not only involving the function of the part, but even the life of the patient.

Encysted tumours, vascular degenerations, and certain forms of cancer, are all not unfrequently seen in the lower jaw. I shall, however, satisfy myself with describing the disease termed osteosarcoma. I do this, as it involves all the surgical considerations connected with the subject. The malignancy of this disease, which is indicated by its physical characteristics and the peculiar diathesis of the patient, renders its extirpation the only alternative for the surgeon.

Osteo-sarcoma of the jaw is similar in every respect to the same disease in other bones; it generally commences in the cancellated structure, and not on the periosteal surface of the bone; it increases with great rapidity, causing the partial absorption of the outer table, which becomes very thin—so much so, that it crackles under the finger like dry parchment. This phenomenon is characteristic of the disease. The frequency of osteo-sarcoma of the lower jaw is doubtless attributable in great measure to the extension of disease from the teeth, which, when decayed, are the source of considerable and continued irritation. Like other malignant diseases, osteo-sarcoma is beyond the control of medicine; as I have before said, operation affords the only chance of relief. The following are the steps of the operation:—A bold and extensive incision must be made through the soft parts covering the bony tumour, the course of the knife following the curvature of the jaw close to its lower margin. An incision is then to be made at either end of the first incision, and at right angles to it; one portion of the integument is to be dissected from the jaw upwards, and the other downwards, so that the bony tumour is completely exposed. The jaw is now to be sawn through at the extremities of the first incision; and when divided, must be depressed and everted, so that the soft parts adhering to the inside may be dissected off; the muscles attached to its base are then to be cut through, and the bone, thus liberated, removed. The facial artery is generally divided in the first incision, and had better be tied immediately, or the hæmorrhage interferes with the after steps. It is necessary to extract a tooth at the point where the jaw is to be cut through, and this should be done before the operation, whether the chain or common saw be applied. If the chain saw is adopted, it must be passed behind the jaw, close to the bone, by means of a needle: the action of the saw being from within to without. After the removal of the bone, the soft parts are brought together, and retained by suture. If the disease be situated so near to the condyle as to preclude the possibility of sawing through between the diseased part and the articulation, the jaw must be disarticulated. In this case the saw is employed only on the symphysis side of the disease; and when the soft parts are dissected off, as in the former case, the surgeon takes hold of the diseased part of the bone, and directing it outwards and slightly backwards, opens the front part of the temporo-maxillary articulation, continuing the knife backwards so as to divide the ligaments of the joint; then, cutting through the temporal and pterygoideus externus muscles, the diseased part is extirpated. Bleeding vessels are then to be secured, and the edges of the wound neatly approximated, and maintained in coaptation by sutures. If there be any enlarged glands, or other signs of the propagation of the disease to the surrounding tissues, it would be both useless and cruel to recommend this operation.

I have performed the operation of excising portions of the jaw two or three times. About a year since, I removed almost the whole of one side of the lower jaw in the case of a young lady, who had a large bony growth which caused great deformity, and interfered very materially with the functions of the parts. The bone was removed from near the symphysis in front, to the neck of the bone posteriorly; it was not disarticulated, but sawed off close to the condyle, which was suffered to remain in its natural situation. After the operation, the parts united readily, and with wonderfully little deformity. This lady paid me a visit a short time since, when I was surprised to observe how slightly the symmetry of her face was injured by the operation, although, of course, the bony support of the whole of the lower part of one side was removed.

The superior maxillary bone is subject to the same diseases as the inferior, and in consequence of its possessing sinuses lined with mucous membrane, it is, in addition to them, liable to a certain class of tumours incident to that tissue. Of the latter description are the tumours which grow from the antrum; these frequently lead to the most dreadful deformities, interfering with the functions of the eye, nose, and mouth; and as these growths are not always of a malignant character, the removal of large portions of the upper jaw for their extirpation may be regarded as an admissible operation, when the diagnostic marks offer a reasonable hope of its effectiveness. The mode of performing this operation is as follows:— An incision is to be made, commencing on the outer side of the orbit, and continuing through the cheek to the angle of the mouth; a second incision is to be made through the commissure of the upper lip, extending quite to the septum of the nose, and being continued upwards so as to separate the ala from the cheek, passing also up the side of the nose, exposing the nasal process of the superior maxillary bone; a flap is thus formed, which may be turned upwards, exposing the whole of the tumour; or if it be so large, or situated so far back, that this flap does not expose the whole, another incision may be made, extending backwards in the course of the zygomatic arch, which will afford additional exposure of the parts. The teeth being, as in the former case, drawn at the point where the bone is intended to be cut through, the jaw is to be divided by the cutting forceps through the alveolar processes, the palatine processes, and the remaining osseous attachments which prevent the extirpation of the disease. An able assistant is required during this operation, to compress the bleeding arteries until it is completed, when they must be secured by ligature, and the soft parts carefully adapted, being well supported by a dossil of lint or a piece of soft sponge, to fill up the immense cavity which has been made. It is impossible to describe, in this general manner, the precise parts at which the section of the bone may require to be made, as it depends wholly upon the extent and direction of the tumour. Hence it is most essential that any surgeon, however bold or expert, should thoroughly make himself acquainted with the precise attachments of the diseased mass, and perfectly make up his mind upon the best mode of procedure before he commences the operation. I have lately removed a cartilaginous tumour growing from the antrum of a child about eleven years of age; but as it had not acquired a very great size, of course the extent of the incisions, or quantity of bone to be removed, was proportionably smaller, compared with the operation I have just before described.

From the liability of mucous membranes to be attacked by suppuration, and from the frequent irritation to which it is exposed during the growth of the teeth, the antrum is not unfrequently the seat of abscess. Although, from its physical character, this disease may perhaps be confounded with malignant disease of the same part, it is not itself dangerous. The symptoms may be enlargement of the superior maxillary bone, attended by irritation of the eye, discharge from the nose, and pain, especially in the act of mastication. Under these circumstances the second or third molar tooth should be drawn, and a free opening made into the antrum by means of a perforation introduced into the alveolar cavity from which the tooth had been extracted: if pus flows, the diagnosis of abscess is at once established; but if blood and a fungous matter exude, it is a proof that the disease is malignant. In abscess, tonic and sedative remedies, with attention to diet and change of air, will be sufficient to produce a cure: in malignant disease, as I have said before, a surgical operation is the only alternative, and even that, I fear, must be looked upon as hopeless.

The region of the neck.—The neck is placed between the thorax and the cranium, and constitutes a continuation of the spine, so that it must be considered rather as an appendix to the trunk than to the head, although Professor Okie, and some other physiologists, consider the bones of the skull as mere modifications of the form of the vertebræ. Seven vertebræ compose the osseous portion of the neck; and it is worthy of remark, that all mammalia, from the giraffe to the mole, possess the same number of cervical vertebræ. The chain of bones constituting the neck is attached above to the cranium, behind the centre of gravity of the skull; leaving a large space between the four upper cervical vertebræ and the lower jaw; this space is occupied by the organs of mastication, deglutition, and respiration, while the three lower bones of the cervical spine are curved more forward, and brought within the central line of gravity of the skull; but these are still destined to support portions of the alimentary and respiratory apparatus. Thus, it will be observed that the neck is not only, as far as refers to bone, the connecting medium between the trunk and the head, but that all the organs which are situated in the region may be considered as extrinsic to it, and forming connecting media between the commencement of the organs of mastication and stomach, and the respiratory passages and the lungs. But besides these organs, the natural contour of the neck is made up of various muscles intrinsically belonging to the important organs I have described, as well as of those muscles which move the head upon the spine, and attach the cervical region to the trunk. All these structures, as well as the head itself, having to be supplied with blood, large arteries and veins pass through the neck to maintain the circulation; numerous nerves also traverse this region in their course from the brain to the organs of respiration and digestion, and the cellular membrane and skin make up its remaining constituents.

Although the length of the neck is to be attributed to its osseous development, there is still a great variety in the apparent proportionable length of this region in different individuals; but this is more to be attributed to the development and formation of the chest than to the construction of the neck itself—a short narrow thorax giving the appearance of an elongated neck, pathologically indicative of a pulmonic diathesis; while a fully developed, deep thorax, encroaches on the cervical region, indicating a plethoric, if not an apoplectic tendency.

In a surgical point of view these considerations are important, inasmuch as operations in the region of the neck, such as the removal of tumours and tying of arteries, are difficult, where the neck is short and stout, and become apparently easy in proportion to its attenuation.

The pharyngeal region.—The pharynx must be considered as constituting a portion of the neck; for although the neck is considered as being bounded above by the lower jaw, and below by the sternum and clavicle; still the pharynx, composed of a layer of muscles, is placed behind the bones of the face, and in front of the four superior cervical vertebræ. It is fixed above to the cuneiform process of the occipital bone, in its centre to the maxillary bones, and cornua of the os hyoides, and below to the thyroid and cricoid cartilages; while posteriorly it is connected by loose cellular membrane to the muscles on the anterior aspect of the spine. In front it communicates with the posterior nares, mouth, Eustachian tubes, and glottis, so that it can scarcely be considered as possessing any anterior parietes, until below the level of the glottis, where it terminates in the œsophagus.

The pharynx as an organ of deglutition, is liable to the intrusion and lodgment of foreign bodies, and, as I have already said, is so intimately connected with other important openings, especially with that of the respiratory canal, that so great an inconvenience must arise from any obstruction as to render imperative the immediate removal of the extraneous matter; and in consequence of the communication of the pharynx with the mouth and fauces, instruments can be readily introduced for the purpose of their extraction. At the same time instances have been known, of suffocation occurring from portions of meat or other substances sticking in the pharynx, and preventing the passage of air into the glottis. The best treatment under these circumstances, where no efficient instruments for the removal of the foreign body are at hand, is to immediately open the trachea, so as to admit air to the lungs, and thus give time subsequently to remove the cause of the danger.

Abscesses sometimes form in the loose cellular membrane, between the pharynx and spine: the pressure of these gives rise to symptoms very similar to those in case of obstruction produced by the presence of a foreign body; but in the former case, the premonitory symptoms constitute sufficiently clear diagnostic marks. When, therefore, dysphagia and dyspnœa are present, preceded by pain in swallowing, febrile action and rigors, and upon examination a tumour presents itself, there is sufficient evidence of the presence of an abscess, evacuation of which at once relieves the urgency of the symptoms.

In performing this operation, trifling as it may appear, some little caution is necessary; as, for instance, the tongue should not be drawn forward for the purpose of obtaining the best view of the abscess; for, although advantage is gained by this, it is more than counterbalanced by the liability of the pus to flow at once into the glottis, which would be widely opened by the protention of the tongue. The pus should be early evacuated, as, in consequence of the laxity of the cellular membrane between the pharynx and the anterior muscle of the spine, there is considerable tendency for the matter to make its way downwards even into the chest. Sometimes the abscess is so far down the pharynx as to be beyond ocular detection. In such a case the passage of an œsophageal bougie will sometimes not only detect the seat of the abscess, but also cause its rupture, and the evacuation of the matter.

I was sent for to a lady, who resided in Westbourne-terrace, and who, after an attack of cynanche tonsillaris, was seized with difficulty of swallowing and breathing, preceded by distinct rigor, and a deep-seated fixed pain in the region of the larynx. I ordered fomentations, and promised to call again in the evening. This I did, taking with me a bougie, which I passed down the œsophagus; the patient was immediately seized with vomiting and brought up a large quantity of pus, showing that an abscess had been ruptured by the bougie.

An abscess may, moreover, result from caries of the bodies of the vertebræ, and instances have been known of portions of exfoliated bone being vomited from the stomach. The after-treatment in such cases must be regulated according to whether the affection results from strumous diathesis or syphilitic taint.

Ulcers on the pharynx are not common, unless they proceed from secondary or tertiary sores, when they of course require to be treated by iodine, and other alterative remedies.

Anterior region of the neck.—When we view the neck on its anterior aspect, several important projections and depressions present themselves, occupying an inverted triangular space, lying between the two anterior edges of the sterno-cleido-mastoidei muscles.

Commencing from above, the symphysis of the lower jaw offers the most prominent point. It is to be considered when the jaw is closed, and forming a right angle with the axis of the body; just below, and an inch and a half behind, the symphysis may be seen (especially in thin persons) a second projection, which marks the situation of the os hyoides; a quarter of an inch below this, the edge of the thyroid cartilage presents itself, forming a third eminence, from whence the larynx takes its commencement, terminating at the lower edge of the cricoid cartilage, its vertical length being about two inches. The thyroid gland forms the next projection, the prominence of which varies in different individuals. From the lower edge of the cricoid cartilage to the sternum measures two inches and a half; and in taking the dimensions of the part, it is better to measure from the cartilage than the gland, as the latter is sometimes difficult to define. Just above the sternum, the supra-sternal cavity is placed; this space is formed by the peculiar arrangement of the cervical fasciæ. On either side of these median projections, a vertical sulcus is distinguishable: it runs along the inner edge of the sterno-cleido-mastoidei muscles, and marks the situation of the carotid arteries, which in thin persons may be seen pulsating beneath the skin.

The whole of this region of the neck is placed anteriorly to the cervical vertebræ, and as it contains the various organs I have already described as so essential to life, it offers many points of the highest interest to the surgeon; perhaps one of the most important of these is in relation to the manner in which the cervical fascia unites all the parts, and at the same time subdivides them, and isolates each structure by forming a distinct sheath around it.

The growth of tumours, and the progress of the formation of abscess, as well as the effects produced upon the neighbouring organs, are modified by the attachments of the fasciæ; these processes should, therefore, be most diligently studied by the anatomical pupil, in order that he may become fully acquainted with the topography of the region.

The supra-hyoideal region.—It is in this region that attempts at self-destruction are most frequently made by what is termed "cutting the throat." If such an attempt be determinedly made, the mouth is laid open; this is attended by a discharge of mucus, mixed with more or less blood and saliva; if the sublingual or submaxillary gland be wounded, a flow of pure saliva also occurs: the power of articulation is greatly interrupted, although the voice itself remains unimpaired.

In these cases the hæmorrhage is the most alarming feature; it depends upon the division of the submental or lingual artery, which, if divided, require ligatures to stop the bleeding; the former may usually be secured at once; but with respect to the lingual artery, it is more difficult, from its being so deeply seated, and if it cannot be secured at the wound, the trunk itself must be tied, as follows:—A piece of sponge or lint is pressed into the wound, to check the bleeding during the operation, and an incision is made through the skin and superficial fascia, commencing a quarter of an inch anterior to and above the cornu of the os hyoides, and extending upwards and backwards towards the anterior edge of the mastoid muscle. The edges of this wound being separated, the tendon or posterior belly of the digastric muscle is exposed, and immediately below it lie the lingual nerve and artery, the nerve being above and somewhat superficial to the artery. I have once tied this artery myself in a case of attempted suicide, and I found the operation extremely difficult, (although on the dead subject it is comparatively easy;) which depends upon the action of the muscles during life increasing the depth at which the artery is situated. If a wound in the side of the throat extends very deeply, the instrument may penetrate into the inferior part of the parotid region to a sufficient depth to injure the gland, the external carotid artery, or perhaps its facial branch. If the latter only be wounded, it may be tied; but if the carotid itself be divided, it would generally happen that the patient would die before assistance could be obtained. I remember, however, an instance, in which an old pupil of Guy's Hospital, a Mr. Tiernan, who had the care of a lunatic, succeeded in putting a ligature around the common carotid, and, by his skill and promptitude, saved the life of the patient.

Tumours sometimes occur in the supra-hyoideal region: the degree to which these project externally depends upon whether they are between the skin and the muscles, or the muscles and the mucous membrane of the mouth; in the last case they would project more into the mouth, and, if requiring extirpation, must be removed through that cavity.

I lately removed a tumour from this region: it was placed between the superficial fascia and the genio-hyo-glossal muscle; and although from its projection and mobility it appeared very superficial, it penetrated so deeply between the muscles as to require careful dissection for its perfect removal; the tumour was composed of enlarged and indurated lymphatic glands.

The glands of the supra-hyoideal region are often secondarily affected in malignant disease of the lower jaw and tongue; when this is the case, it forcibly indicates the impropriety of resorting to operation for the removal of the original affection.

The central region of the neck comprehends the space between the under surface of the os hyoides and the inferior edge of the cricoid cartilage; I shall term it the

Laryngo-pharyngeal region.—Wounds in this part are also not infrequent from the hand of the suicide, and the cutting instrument may divide the space between the os hyoides and the thyroid cartilage, between the thyroid and cricoid cartilages, or between the cricoid cartilage and the trachea, or it may, indeed, divide the cartilages themselves; in either case, however, the resulting phenomena would indicate the nature and situation of the injury. If, for instance, the wound penetrates between the os hyoides and thyroid cartilage, the thyro-hyoideal ligament will be cut through, the pharynx laid open, and its contents probably protruded: air also passes from the wound, producing often more or less emphysema, and speech is impaired, if not destroyed. The bleeding is here usually comparatively slight, as the superior thyroideal artery alone is liable to be wounded, unless the incision extends laterally to a sufficient degree to reach the carotid artery and jugular vein; but the superior laryngeal nerve is very likely to be divided; and, if that were to happen on both sides, the loss of sensation in the larynx would probably lead to suffocation, from the blood passing down the glottis; for, as the presence of the intruding matter would not be indicated, in consequence of the loss of sensation, there would be no effort to expel it by coughing. Should there be bleeding from the superior thyroidal artery, and the attempt to secure its truncated extremity not succeed, the trunk of the artery must be tied; and, with this object, an incision must be made through the skin and fascia of the neck, commencing immediately below the cornu of the os hyoides, and extending outwards and downwards for an inch and a half towards the mastoid muscle: the artery is thus exposed, several small veins lying across it, and the superior laryngeal nerve behind it. I have seen Sir Astley Cooper put a ligature around this artery for the disease of the thyroid gland termed bronchocele: it proved, however, ineffectual. If the carotid artery itself be divided in the laryngo-pharyngeal region, there is but little chance of the patient surviving even until surgical assistance could be obtained. If the cutting instrument be directed deeply backwards, and at the same time takes a downward direction, the apex of the epiglottis may be wounded. In such a case, a complicated train of symptoms would be presented by the interruption to the functions of respiration and deglutition. If the wound be inflicted between the thyroid and cricoid cartilage, the vocal chords and epiglottis are almost certain to be injured, and the voice greatly impeded or totally lost; blood and air rush out of the wound at each expiration, while every time the air is drawn into the lungs, cough is produced by the blood passing into the glottis.

Should the incision in "cut throat" be through the thyroid or cricoid cartilage, the danger of suffocation is increased, as, owing to the elasticity of the tissue, the wound is immediately closed, and the blood cannot be expelled through it. The object in these cases is to secure the bleeding vessels as quickly as possible.

LECTURE XXXIV.

CONTINUATION OF THE LARYNGO-PHARYNGEAL REGION.

Wounds in this region—Foreign bodies lodged in the rima glottidis—Symptoms of the intrusion of a foreign substance—Case—Fixed bodies in the air-tube—Treatment—Cases—Foreign substances impacted in the bronchi—Mr. Liston's case—Mr. Key's case—The suffocation from the presence of extraneous substances not common asphyxia—Opening in the trachea for œdema, or ulceration of the arytænoid cartilages—Opening the œsophagus.

Diagnosis in abscess of the region—Case—Supra-clavicular region—Laceration from wounds—Case—Tumours—Difficulty in their diagnosis—Removal—Wry neck—Cause—Treatment.

Posterior region of the neck—Unimportance of the surgery of this region—Carbuncle—Danger of wounds in the region.

Incisions between the cricoid cartilage and trachea immediately destroy the voice, as the expired air rushes through the wound and prevents the vibration of the vocal chords. Wounds in this situation are extremely dangerous, as the parts offer very little resistance to the cutting instrument, which frequently penetrates, therefore, to a sufficient depth to divide the carotid artery and jugular vein; and even should these vessels escape, the division of the inferior laryngeal nerves might lead to suffocation, from the inability to cough up the blood through the paralysed trachea.

It is in this situation that the operation of opening the windpipe is performed, when a foreign body has passed into the glottis, and is lodged in the rima glottidis. This part is selected, as it affords an immediate opening for the passage of the air, and is at the same time conveniently situated for the dislodgment of the extraneous matter. If, however, œdema of the glottis occurs from swallowing acids or hot water, the opening should be made in the trachea, as the part just mentioned may participate in the swelling produced by the accident.

If any portion of the space between the cricoid cartilage and sternum be wounded, the trachea can scarcely escape injury, the œsophagus is also likely to suffer, and from the comparatively superficial situation of the carotid arteries, they are liable to be divided. It is in this space also that the windpipe is opened for the extraction of moveable foreign bodies which have accidentally passed through the glottis. The symptoms which accrue from such an accident are often very insidious; but as the removal of the substance which has entered the glottis is absolutely necessary to save the life of the patient, every exertion should be made to ascertain with certainty whether any extraneous body has really intruded itself. The symptoms are usually as follows:—A child at play, having perhaps put beads or pebbles into its mouth, is suddenly seized with a violent fit of coughing of a most remarkable character: the eyes are starting; the vessels turgescent, and the lips blue; and sometimes the child falls, after a few moments, from complete exhaustion. A surgeon is probably sent for; but when he arrives he often finds that the cough and other symptoms have ceased, and, indeed, the patient appears to have recovered from the attack. This is, however, merely a deceptive calm: the course of the trachea and bronchi should be examined with the stethoscope; and if the patient be old enough, he should be questioned as to whether he is conscious of the presence of any substance in the windpipe. Generally in such a case a flapping noise can be heard upon placing the ear over the cricoid cartilage: this is produced by the foreign body striking against the rima glottidis, and every beat is generally followed by a recurrence of the fit of coughing. A repetition of these physical signs is quite sufficient to determine the diagnosis, and no time should be lost in adopting means for the removal of the extraneous body. Some surgeons have recommended that the patient should be laid prone on an incline of 50° or 60°, with the head downwards; and while in this position, his shoulders should be struck for the purpose of dislodging the foreign body, if it be impacted in one of the bronchial tubes. It appears to me, however, that this mode of proceeding is extremely dangerous, unless an opening be first made in the trachea for the admission of air; for should the substance be driven by a violent effort to the rima glottidis, and become fixed there, there is not only imminent danger of the patient being suddenly choked, but of some vessel in the head or lungs giving way under his efforts, particularly in the position in which he is placed.

In the well-known case of the eminent engineer, who was under the care of Sir Benjamin Brodie and Mr. Key, all attempts to relieve the patient from the urgent symptoms failed, until an opening was made in the trachea. The reason for this seems obvious; for if before an opening be made, the foreign substance be forced up to the rima glottidis, the air-tube is closed, and unless a powerful inspiration drives it back again, suffocation must immediately result:

even if it be dislodged, no permanent benefit can be attained; while, on the other hand, if after an opening be made the foreign body reaches the glottis, breathing is still carried on, and the rima glottidis remains quiescent, until, in the act of coughing, the arytænoid muscles enlarge the rima glottidis, and permit of the expulsion of the intruded body. A few months after the occurrence of the above case, a boy about fourteen years of age was sent up to me from Foots Cray, who said that he had got a pebble in his windpipe. He suffered, however, so little, and the stethoscopic signs were so equivocal, that I thought it possible he might have ejected the stone in a fit of coughing, and that the irregular sounds might depend upon the injury the foreign body might have inflicted upon the mucous membrane of the windpipe; although it must be observed that the patient himself felt convinced that the stone was still there. The next day Dr. Addison examined the boy with me, and as he distinctly heard the flapping noise I have spoken of, I determined upon attempting the removal of the stone. I first made a longitudinal incision of about an inch and a half in length midway between the sternum and cricoid cartilage, and, exposing the trachea, fixed it by means of a hook, while I divided with a sharp-pointed bistoury three of the rings; there was no bleeding to interrupt the course of the operation. The patient was then placed head downwards on an inclined plane, as already described, and in about three or four minutes the stone fell into the hand of Mr. Hilton, who was kindly assisting me. The boy recovered without the occurrence of a bad symptom. A piece of muslin was placed over the wound in the trachea, to prevent the intrusion of dust or any foreign matter, and the temperature of the ward was such as not to require to be raised artificially to prevent the injurious effects which result from admission of cold air into the lungs; for it is to be remembered, that naturally the air is warmed in its passage through the mouth, nose, and that portion of the air-tube above the opening which had been artificially made.

It sometimes happens that the bodies which intrude themselves into the trachea are of such shape and character, that they become at once fixed in the tube, instead of moving under the influence of respiration. Such bodies produce less immediate urgent symptoms than those that move in the air-tube, as they are not so likely to interfere with the rima glottidis; the periodical spasms are consequently absent.

The mode of removing such substances would differ therefore from that which has already been described; for it would be necessary to extract them by means of forceps of various shapes, introduced into a factitious opening in the trachea. Mr. Liston removed a large piece of bone from the right bronchus of a female, and this is, I believe, the only instance in which the operation has ever been successfully performed. In this case, the extraneous substance had remained in the bronchus for six months, rendering the patient subject to frequent attacks of bronchitis; this condition was indeed threatening phthisis, and it was this which induced Mr. Liston to resort to the operation as the only means of preserving life. In describing the operation, Mr. Liston states that the introduction of the forceps was productive of the most violent effects, but after the patient had recovered from the spasm which was at first excited, he succeeded in grasping and removing the substance.

Small coins or similarly shaped substances may also require to be removed by the forceps; for if they become fixed edgewise in the tube, they do not move under the influence of respiration, and therefore can only be dislodged by mechanical means.

Mr. Key attempted this operation on a man who had a sixpence in the right bronchus; but the patient died suddenly while under the operation. It apppears to me that some very important pathological deductions may be made from these two last cases: in the first, the foreign substance had been sufficiently long in its situation to enable the mucous membrane to become in some degree adapted to its presence; while in the second the parts remained in their normal highly sensitive condition, and unfit to sustain the irritation inseparable from the introduction of the forceps. This instrument should, therefore, in my opinion, never be employed, if the extraneous body moves within the trachea; for even if it be impacted in the rima glottidis, an opening in the trachea below it at once saves the patient from suffocation, and gives time for the position of the substance to be changed; while the introduction of forceps alone may produce such violent symptoms as are sufficient to cause sudden death. This appears to result (as we frequently see in the fatal termination of tetanus) from violent spasmodic contraction of the glottis—an effect which cannot be referred to simple asphyxia: for in ordinary suffocation, some minutes will elapse before dissolution ensues; while in the above cases death is produced instantaneously. The immediate cause of death under these circumstances is yet quite inexplicable.

The operation of opening the trachea for diseases of the larynx is sometimes resorted to, when, either from œdema about the glottis, or from ulceration of the arytænoid cartilages, difficulty of breathing becomes urgent; but most of these cases, particularly the latter, terminate fatally: I believe, however, generally because the operation is not had recourse to until the disease of the arytænoid cartilage has proceeded beyond the possibility of reparation; and I am strongly inclined to recommend the opening of the trachea at an earlier period, as it affords the only means of keeping the arytænoid cartilages in a state of rest—a condition essentially necessary to the recovery of every inflamed joint; in this case, such an operation affords the only means of attaining the desired object. I have once succeeded in curing ulceration of the arytænoid cartilages by the above plan, with a rapidity that I have never known to result in any other mode of practice. I was consulted by an officer in the Indian service, who was sent home on sick leave, with protracted secondary symptoms; he had ulceration of the throat, attended by loss of voice, great pain of the larynx in speaking, and even in forced respiration; upon grasping the larynx, the pain was greatly increased. I prescribed iodine, iodide of potassium, with opium, and the remedies usually employed in such cases; the ulcers in the throat healed under this treatment, but the laryngeal symptoms increased in urgency. I proposed to make an opening in the trachea, and when I explained the object of this operation, my patient readily consented, and in the course of three months, he had completely recovered, with the exception of a slight alteration in his voice, which proceeded probably from anchylosis of the left arytænoid with the cricoid cartilage. My colleague, Mr. Cock, has within the last two years saved the lives of several children by opening the trachea to relieve the violent dyspnœa arising from the œdema caused by swallowing hot water; in this case the relief is not merely that derived from the admission of air into the lungs, but also from the state of quiescence in which the parts are allowed to remain.

The following case was sent me by a surgeon in the country. I give it in his own words:—

" — Weatherley, æt. two years, was brought to me on the evening of October 11, 1848. She is a stout healthy-looking child, fat and short neck.

" In the afternoon of that day, she went to the tea-kettle, and managed to drink some of the boiling water. Some hours elapsed before she was brought to me, and while carrying her across the field, her parents thought several times that she had ceased to breathe. I found her face livid, and somewhat puffy—respiration much obstructed—the whole of the mouth and pharynx blistered. I immediately insisted on the operation of tracheotomy, which the parents at length assented to. I will say nothing of the difficulties—both my attendants were on the borders of syncope. I found I could not get conveniently at the trachea with a trocar and canula; indeed, they were too large for my patient; so, with my left finger on the trachea, I directed a sharp-pointed bistoury into it, and bringing it upwards, divided a ring of the windpipe; this opening I enlarged, then I endeavoured to pass the trocar and canula, but without success, and I was on the point of giving it up, when I bethought me of a gum elastic catheter; this succeeded, and I then secured it."

"The child did not lose much blood, but was rather faint; a few drops of sal volatile in water were put between its lips, but little swallowed. ℞. Hydr. chlor. gr. v. 2ndis horis.

"12th. Tolerably comfortable during the night—once or twice restless, when the tube got clogged up. Pulse quiet.

"13th. Continues to mend; has had green stools from the effect of the calomel; has taken a little arrowroot, &c.

"The calomel was continued for some days, and gradually left off. The patient recovered without a bad symptom. In about a fortnight, I removed the tube, and the wound speedily closed. The child is now quite well.—Nov. 3rd, 1848."

Foreign bodies sometimes lodge in the œsophagus, in this region of the neck, and from being tightly impacted, they resist the application of the probang: under these circumstances, their removal is effected by cutting down to the œsophagus at the point where the body is felt, making the incision at the left side of the trachea: the substance must be removed by forceps. Considerable precaution is requisite in exposing the œsophagus, not only from its natural proximity to the carotid sheath, but because in its dilated state it encroaches still more on that artery.

The supra-sternal fossa, which I have already spoken of as being placed at the inferior extremity of the triangular space comprising the anterior region of the neck, is sometimes the seat of abscess; and when the matter escapes externally from this point (which often happens from ulceration of the fascia), there is some difficulty in healing the wound, owing to the mobility of the part; there is also difficulty of breathing and alteration in the voice; from the trachea having lost its support from the fascia, the pressure of the atmosphere interferes with the natural functions of the canal: such abscesses are frequently connected with the absorbent glands and loose cellular membrane of the anterior mediastinum.

In describing the limits of the anterior cervical region, I stated that it was bounded on either side by a deep sulcus, in which the carotid arteries may be seen pulsating as they take their course from the chest to the thyroid cartilage, where the common carotids terminate by dividing into the external and internal branches. It is in this course that ligatures are applied to the common carotid in wounds, aneurism, and in some cases where the supply of blood to a diseased structure appears to maintain the diseased action.

The carotid artery may be tied in any part of its passage through this sulcus, but as the omo-hyoideus muscle, in its course from the os hyoides to the shoulder, crosses the carotid sheath, the application of a ligature on the artery above the muscle is termed the high, while that below is contra-distinguished as the inferior operation.

The carotid artery in these two situations is very differently placed with respect to the structures that cover it : above the omo-hyoideus and the cricoid cartilage, it is only covered by the skin, platysma-myoides, and fascia of the neck; but still it is not so superficially placed as would be thought from an examination of the dead subject, for by the contractions of the sterno-cleido-mastoideus muscle, and the motions of the larynx during life, the relative depth of the vessel is continually changing.

Below the omo-hyoideus muscle, between it and the sternum, the carotid is more deeply seated, and is covered by the sterno-cleido-mastoideus, sterno-hyoideus, and sterno-thyroideus muscles, as well as by the skin, platysma-myoides, and cervical fascia.

Within the carotid sheath (a covering produced by the deep fascia of the neck), is placed not only the artery, but also the internal jugular vein and pneumo-gastric nerve; the former lying on the tracheal or inner side, the vein on the outer, and the nerve between the two.

The internal jugular vein is subject to dilatation, so that the swelling presents itself in the carotid sulcus, and the surgeon may find it difficult to distinguish it from disease of the carotid artery itself, as, from the vicinity of the swelling to that vessel, it more or less partakes of its pulsating nature. A patient was admitted into the London Hospital, with a swelling about the size of an egg on the right side of the neck; it was at first suspected to be carotid aneurism; upon further examination, however, it was believed, from the softness of the tumour, the facility with which it was emptied, and the slightness of the pulsation (and that not quite synchronous with the action of the heart), that it was disease of the vein, and not of the artery; the absence of the *bruit de soufflet* also tended to confirm this opinion. The patient died a short time after of disease of the lungs, and the diagnosis was found to be correct.

Burns, in his work on the *Head and Neck*, mentions instances of dilatation of the internal jugular vein, forming a pouch of considerable size behind the angle of the lower jaw, but he does not mention that the tumour partook of the pulsation of the carotid artery; and, therefore, the diagnosis would be more easy here than if it occurred lower down in the neck, where the proximity of the two vessels is greater.

Strumous abscesses of the neck may sometimes lead to ulceration of the carotid artery, producing spurious aneurism. A well-known case of the late Mr. Liston is worthy attention. An attempt was made to attach blame to him, but a short history of the case will, I think, prove that this was great injustice. A child of highly strumous habit, with several cicatrices on the neck, indicating that the strumous tendency was of long duration, was admitted into the North London Hospital. He had a fluctuating tumour on the neck, in which the house-surgeon had discovered a pulsatory motion, and on Mr. Liston's visit, he mentioned the circumstance to him; Mr. Liston, however, considering the youth of the patient, the proof of the existence of former abscesses, and the unheard-of existence of aneurism at so early an age, and believing that the pulsation was merely communicated to the mass, and did not arise from the opening of any vessel into it, punctured the tumour; arterial blood rushed from the wound, which was directly closed, so as to stop the hæmorrhage; and the next day the carotid artery was tied. The rare occurrence at any time of life of the ulceration of an artery from abscess, the peculiar diathesis and temperament of the patient, the frequency of a pulsating motion being communicated from an artery to a tumour in its neighbourhood, and a knowledge that nothing else could be done than tie the artery (if it should prove to be aneurism), led Mr. Liston into the error of opening the tumour in this case. The exploration does not, therefore, deserve the condemnation that has in some instances been attached to it. The case, however, affords ample instruction, pointing out the paramount necessity for the closest investigation before an abscess in the vicinity of a great artery is opened.

A small triangular space above the clavicle, bounded on the inner side by the sterno-cleido-mastoideus, on the outer by the trapezius muscles, and terminated above by the approximation of the two, is termed the supra-clavicular region. The passage of a portion of the subclavian artery through this space renders it important to the surgeon. At this point of its course, the subclavian artery can be pressed against the first rib, so as to command the circulation through it during operations in which it is requisite that the flow of blood should be checked.

Injuries in the supra-clavicular region may produce laceration of the subclavian artery or axillary nerves; still they are so defended by the clavicle, that their laceration can scarcely occur immediately from an external force, but is most frequently produced from the bone itself being broken, the laceration being caused by the sharp fractured extremities. The following case of this kind was admitted under my care at Guy's Hospital:—William Morgan, a sailor, eighteen years of age, had fallen from the mast-head of a vessel upon a "belaying pin," which entered his chest just above the clavicle, and, penetrating about seven inches, broke off, and the patient was precipitated into the Thames. He was immediately picked up, and conveyed to the house of Mr. Randall, a surgeon at Rotherhithe, who extracted the fragment of the pin: this required considerable force, and was followed by profuse hæmorrhage. Upon his admission into the hospital, he complained of great pain in the shoulder, and an uneasy sensation in the abdomen; there was also considerable contusion about the head. A large lacerated wound presented itself above the clavicle, of the breadth of three fingers. Through this the clavicle could be felt broken into two or three portions, and the subclavian artery was laid perfectly bare, as it passed over the first rib. There was emphysema extending from the neck, down the side and back. The surface of the body was cold, and the abdomen tympanitic, with partial priapism. The edges of the wound in the supra-clavicular region were partly brought together by strips of adhesive plaister, an opening being left to permit of the exudation of blood. Julep. ammon. was given, to produce reaction, and fomentations were applied to the abdomen. He died, however, the day after the accident. On examination of the body, it was found that the wound extended from the left clavicle into the axilla, and the subclavian artery was lacerated. On further dissection, it was discovered that the wound extended from the axilla into the chest between the third and fourth ribs, penetrating the lung; and a piece of cloth torn from his jacket by the belaying pin was firmly fixed in the wound, forming a plug, which probably prevented immediate death from hæmorrhage. On opening the abdomen, the spleen was found lacerated on its inner and posterior surface. In this case, had there been no laceration of lung or spleen, and had hæmorrhage occurred on reaction, a ligature upon the subclavian artery might have saved the life of the patient.

The subclavian vein may also be wounded by the sharp ends of a fractured clavicle. This happened in the case of a late celebrated statesman, who died, as I am informed, in consequence of laceration of the above vessel. Although there was no post-mortem examination permitted to verify the diagnosis, the symptoms were of a character to remove almost all doubt as to the nature of the injury. They were as follow:—A swelling occurred immediately over the point of fracture of the clavicle. This swelling was at first fluctuating, and the fluid it contained seemed to be under the influence of the heart's action. In a few hours the tumour became solid, and then the pulsation of the heart became still more evident. The bleeding which formed the tumour in the first instance, was probably checked by the blood being confined between the pleura and the fascia of the neck; for if either of those tissues had been ruptured, the swelling would have been more diffused, and it would be difficult to explain why the bleeding had stopped.

Tumours sometimes form in the supra-clavicular region, and, as they may possibly gain a pulsatory motion from the subclavian artery, they may be mistaken for aneurism of that vessel; and in this situation I have known abscesses, glandular enlargements, and exostoses, lead to great diagnostic difficulties.

High up in the lateral region of the neck, between the trapezius and sterno-cleido-mastoidei muscles, tumours are frequently seated. These are generally glandular, but are sometimes of a fluctuating character, when it becomes difficult to decide whether the swelling is chronic abscess or an adventitious serous cyst. The latter I have termed hydrocele of the neck. Two of these cases have occurred in the course of my practice, both of which were cured by the application of setons.—*Guy's Hospital Reports,* vol. i. p. 105. In the dissection of tumours from this region, or indeed from any part of the body in which large vessels or nerves are situated, the surgeon should always be prepared with strong hooked forceps, to draw the tumour from its bed as soon as it has been exposed; and in the dissection, the edge of the knife should always be directed to the tumour, as if the surgeon were dissecting the neighbouring parts from the tumour, rather than the tumour from the parts. The most common operation in the supra-clavicular region is phlebotomy of the external jugular vein. The vessel is here placed under the platysma-myoides muscle, and decision and accuracy are required to enable the surgeon to lay open the vein.

In wry neck, division of the sterno-cleido-mastoideus is sometimes recommended; but if the distortion has arisen without external injury, as from burns, or cicatrices from other causes, the operation is useless, as the deformity probably depends upon disease of the cervical vertebræ, or spinal nerves. It may be very difficult to ascertain whether the distortion results from paralysis of the opponent muscle, or spasm of that affected; and, if the latter, whether the affection be idiopathic or sympathetic. If paralysis be suspected, electricity, strychnia, blisters, and the internal administration of mercury, are indicated; but if the contraction results from affection of the muscle itself, its division, and, at the same time, that of the accessory nerve which passes through it, may be had recourse to.

Contractions after burns may render operations in any region of the neck necessary, as the deformities may affect most important vital functions; when the chin is drawn downwards towards the sternum by the violent contraction of the cicatrices, deglutition and respiration are interfered with, and the voice becomes altered. From the tendency to eversion of the lower lip, the saliva is constantly flowing from the mouth, and the deformity renders the unfortunate object unfitted for social life. Division of the cicatrix is not sufficient to remove these distortions, as the muscles have usually become permanently shortened, and have adapted themselves to the abnormal condition of the parts. Portions of them, therefore, or indeed the entire muscle, where it is not of any great dimensions, should be divided by transverse incisions, as the tissue which reunites them, being always incapable of contraction, may check the liability to recurrence of the deformity; and if the healthy part of the muscle still has a tendency to contract, the elasticity of the reuniting medium will offer but little resistance to the subsequent means employed for the purpose of preventing the drawing down of the head. In the neck I believe it is the contraction of the platysma-myoides muscle, and not that of the granulations, which produces the deformity; for extension alone during the granulating process after burns will scarcely ever prevent the occurrence of these contractions.

Before dismissing the region of the neck, I must for a moment dwell on the circumstance of its being frequently the seat of the attempts both of the assassin and the suicide: it may be the object of the former to endeavour to impress the belief that death had been produced by the hand of the individual himself; and it is therefore highly important that the surgeon should be thoroughly acquainted with the signs that enable him to determine whether the violence was inflicted before or after death.

The posterior region of the neck offers but little opportunity for surgical remark, the bloodvessels being comparatively unimportant in this region, so that wounds offer no difficulties with reference to hæmorrhage; but it may be remarked that the strong fascia may somewhat interfere with the union of wounds of these parts. Particular notice is, however, required in reference to this region, as it is often the seat of carbuncle; and, probably, the severer symptoms attending the disease in this part of the body, are also attributable to the low degree of vital power possessed by the fascia so abundantly developed here. Deep sinuous ulcerations also frequently occur in this region, arising from sloughing of the ligamentum nuchæ, or from disease of the vertebræ. The disease is extremely difficult to cure, requiring free incisions for the removal either of the sloughing tendon or bone, whichever may be the cause of the malady. The part of this region most assailable, and where wounds are most dangerous, is its upper extremity, between the atlas and vertebra dentata. In this space, the spinal marrow is only protected from external injury by soft parts, so that a deeply penetrating wound might divide the spinal marrow, and produce immediate death.

LECTURE XXXV.

CONTINUATION OF SURGERY OF THE REGIONS.

Thoracic region—Its anatomical relations—Sternal region—Congenital malformation—Absorption of sternum from abscess—Venereal nodes on sternum — Trephining the sternum — Infraclavicular region — Aneurism of arteria innominata — Lateral regions of the chest—Paracentesis thoracis—Puncturing the pericardium—Dorsal region of the chest—Steatomata—Spina bifida—Distortion of the spine—Diaphragmatic region—Penetrating wounds — Wounds of diaphragm—Superior region of chest—Abnormal condition of the thymus gland—Fatal character of deeply penetrating wounds in any part of the chest — Abdomen — Importance of its viscera — Anatomical relations — Division into regions—Contents of each region—Internal abdominal fascia — Injuries to the abdomen — Mere contusion of parietes—Wounded parietes—Protrusion of viscera—Viscera wounded.

THE THORACIC REGION.

The cavity of the thorax is situated between the cervical region and the abdomen: it contains the organs of respiration, and their investing membranes, the pleuræ; the heart with its envelop, the pericardium; and the mediastina with their contents.

The thorax has a direct internal communication above with the neck, and below with the abdomen, for the continuation and transmission of organs from one of these regions to the other.

In the anterior or sternal subdivision of this region, the following are the principal considerations that present themselves to the surgeon:—Being situated precisely in the mesian line, it is very liable to congenital malformations, and is sometimes bifid through almost its whole extent, leaving only a soft tissue between, through which the action of the heart is distinctly to be felt.

The bifid formation of the ensiform cartilage is very common; and I have met with cases in which the structure was so inverted as to form a deep substernal fossa. A gentleman once called upon me complaining of constant disposition to vomit immediately after having taken a meal or drunk a large draught: being in other respects, however, in perfect health. As I was not able to discover from the history of the case any symptoms that could indicate the cause of the disorder, I made an examination of the abdomen, to ascertain if there existed any tumour or other abnormal condition, which could produce the effect I have described. Upon exposing the person of the patient, I was at once struck with the peculiar form of the termination of the sternum; I thought this might have been produced by a blow, but the patient told me that it had existed from his birth. From the extent of the depression, and its interference with the functions of the stomach, the case was one of considerable interest; I therefore sent the patient to my neighbour Dr. Burn, that he might examine him. Dr. Burn agreed with me that the symptoms could only be attributed to the malformation, although many authors have denied that inversion of the sternum ever produces any effect upon the stomach.

The following is a case in which the sternum was altogether absent—the sternal extremities of the clavicles being steadied merely by the interclavicular ligament. Eugene Groomen, a boy æt. 17, a native of Hamburgh, born without a sternum; the ribs of each side appeared to be connected with one another by cartilage, but there was a totally vacant space in the mesian line of the thorax, and the cartilaginous union of the extremities of the ribs seemed to be inverted on both sides. The beating of the heart was quite perceptible in the interspaces, and during strong inspiration the whole space, which should be normally occupied by the sternum, became filled with an elongated swelling formed by the protrusion of the lungs. The boy was pale, emaciated, and weak, complained of great thirst, but had bad appetite and sometimes difficulty in swallowing: his memory was bad, and he took no pleasure in the ordinary amusements of youth, but was extremely fond of reading and other sedensary occupations.

The sternum is sometimes absorbed, in consequence of internal pressure produced by abscess or glandular enlargement within the anterior mediastinum; if the pressure arise from abscess, the matter may ultimately discharge itself, but the tumour may be mistaken for aneurism, from the impulse it receives from the heart's action. A medical student once called upon Sir Astley Cooper, to request his opinion upon a pulsating tumour under the sternum, which had been pronounced by several eminent members of the profession to be aneurism of the aorta. Sir A. Cooper found, however, that the tumour was nothing more than an abscess in the mediastinum, and that the pulsation depended upon its pressure upon the heart. An incision was immediately made in the skin, and as the matter had already made its way through the sternum, it was readily evacuated, and in three months the patient had perfectly recovered. The remains of the thymus gland may sometimes undergo abnormal change, and pressing upon the aorta and pulmonary vessels, produce urgent symptoms very difficult to diagnose.

Venereal enlargements often occur in the region of the sternum, producing distinct nodes; the specific cause can only be arrived at by an acquaintance with the history of the case, or the existence of concomitant syphilitic symptoms, such as sore throat or venereal blotches. Under these circumstances alterative remedies are of course indicated.

To assist nature in the removal of carious portions of the sternum, or to evacuate the pus in abscess of the anterior mediastinum, it is sometimes advisable to employ the trephine; this method of procedure has been recommended by French surgeons for the evacuation of the fluid in hydro-pericarditis.

Fractures of the sternum, and dislocations of the sterno-clavicular diarthrosis, have already been described: it is, however, in this region that the deformities resulting from these accidents would be obvious.

On either side of the mesian line, at the upper portion of the chest, and immediately under the clavicle, is placed a transverse depression, which may be designated the infra-clavicular region. In this space deep-seated abscesses may form, and so surround the subclavian vessels as to render the evacuation of the pus dangerous, unless due precaution be taken: it frequently happens that matter forms in this region in phlebitis, produced by injury to the hand in dissection; this is usually attributed to the absorption of a morbid poison, but it is, I am inclined to believe, most frequently the result of a peculiar constitutional condition of the individual at the time of the infliction of the injury.

At the point of junction of the right infra-clavicular with the sternal region, the pulsatory motion communicated in aneurism of the arteria innominata may be detected. This vessel has in some instances been tied for aneurism: it is highly important in such cases to ascertain that the arch of the aorta itself is not implicated in the disease, and this is sometimes not easily determined with certainty.

The *lateral regions of the chest* are often rendered unsymmetrical by distortions of the spine, which produce projections on one side and corresponding depressions on the other. In speaking of rickets, I have already described the treatment to be adopted in these cases. Projection of the ribs on one side may also proceed from a collection of fluid in the cavity of the chest; these cases fall more frequently, however, under the care of the physician, until the surgeon is called upon to perform the operation of paracentesis thoracis to evacuate the fluid. In this operation the patient may be placed either in the recumbent or sitting posture: the trocar is to be introduced in the intercostal space between the eighth and ninth rib, close to the superior edge of the lower, and about two inches anterior to its angle. The object of this choice of position for the opening is to avoid the intercostal artery, which runs along the inferior edge of the rib from the angle to the cartilage, and is therefore protected in this locality, while posterior to the angle no certain point can be indicated in which the artery may not be injured.

Puncturing the pericardium in hydro-pericarditis has been sometimes recommended; the operation must be performed in the left intercostal space between the third and fourth ribs. The opening must be made two inches from the sternum, for the purpose of avoiding the internal mammary artery. This is an operation but rarely had recourse to, in consequence of the great difficulty of ascertaining with any certainty the actual presence of fluid within the membrane, and from the danger of wounding the heart, if none be present. I defer speaking of the surgery connected with the mammary region, until I treat of the diseases of the breast, which in itself constitutes so important a subject as to deserve distinct consideration.

There are but few points of surgical importance connected with the posterior or dorsal region of the chest, as the only structures entering into its composition are the cutaneous and muscular coverings to the posterior extremities of the ribs and dorsal vertebræ, and that portion of the spinal marrow contained within them. The subcutaneous cellular tissue, from its laxity to allow of the free motion of the scapulæ and the muscles belonging to them, is frequently subject to morbid growths of fat, termed steatomata. These are frequently so adherent to the fascia as to require in their removal careful dissection from that tissue; to secure the healing of the wound, the upper extremity on the affected side should be confined to the trunk, so as to prevent its motion from interfering with the reunion.

The vertebræ of this region are sometimes affected in children by the disease termed spina-bifida; this abnormal condition results from an arrest in development, and not from actual disease. The deficiency in nutrition is found principally in the laminæ of bone constituting the arch of the vertebræ, which consequently do not unite posteriorly to join the spinous process, the medulla spinalis is at this point unprotected, and protrusion of the spinal chord and membrane is the consequence. This condition is more frequent, however, in the lumbar than in the dorsal region. Sir Astley Cooper many years ago recommended puncture of these tumours for the evacuation of the fluid they contain, and in some few cases a permanent cure has been effected by this operation, although the statistical accounts of its results cannot be said to lead to a favourable prognosis. The distortion of the spine in this region in case of rickets, is sometimes productive of great alteration in the form of the chest, appearing as if diminishing the capacity of that cavity, but in point of fact, a compensating influence is generally in operation to maintain the actual dimensions of the space necessary to the free action of the lungs. To prove how much the position of the ribs is accommodated to this condition, you will find that if a lung becomes adherent to the mediastinum in consequence of pressure, from an accumulation of pus within the pleura, however the ribs may have been projected by its presence, soon after the fluid has been evacuated they become depressed, so as to present a convexity inwards, to fill up the vacuity which the adherent lung is no longer capable of occupying.

The considerations connected with *the inferior* or *diaphragmatic region* of the chest, relate much more to internal diseases than to physical injury; it may, however, be the subject of lesion from penetrating wounds, in which the viscera of the chest or abdomen, or both, may be implicated. The nature of this accident is obviously only to be ascertained by the train of symptoms arising from the altered function of the organ. The diaphragm may sometimes be ruptured by a blow without any external lesion: distention of the abdomen from any cause would of course produce a liability to this accident.

A patient was brought into Guy's Hospital who had received a severe blow on the abdomen, unattended, however, by external wound; there was no collapse, but he complained of severe cramp and spasm-like kind of pain deeply seated in the epigastrium, attended with a short snatching kind of breathing, as if a rib were broken, which was considered, from his symptoms, to be the case. The dresser, Mr. Day, applied a bandage around his thorax, which gave considerable relief; he was also bled, and small doses of tartarized antimony, combined with a neutral salt, were exhibited. The patient remained much in the same state for about ten days; he then began to suffer from occasional sickness after eating; his countenance was anxious, and he died three weeks after the accident. Upon a post-mortem examination, it was found that the diaphragm had been ruptured on the left side, the rupture extending from its muscular into its tendinous structure; the stomach had also become adherent to the edges of the opening, which accounted for the sickness.

Owing to the contiguity of the pleuræ to the upper, and that of the peritonæum to the under surface of the diaphragm, inflammatory attacks frequently extend themselves from one of these splanchnic membranes to the other, producing great difficulty in the diagnosis; this has, however, to be contended with by the physician rather than the surgeon.

The superior boundary of the chest is entirely osseous, and constitutes an opening for the transmission of organs, the important functions of which are in great measure secured by the solidity of the circumscribed opening and by the peculiar arrangement of the cervical fascia, which is continued from the region of the neck into the thorax. The chief surgical points relating to this locality have already been mentioned in describing those of the supra-sternal fossa; it may, however, be remarked, that in children the thymus gland becomes sometimes abnormally enlarged, extending upwards in front of the trachea, occasionally even as high as the thyroid gland. If, under these circumstances, it became necessary to perform the operation of tracheotomy, great difficulty would be experienced from the presence of the abnormal growth; indeed, owing to the shortness of the neck, and comparative depth of the trachea in young children, laryngotomy should always be preferred to tracheotomy wherever it is admissible.

Any reference to the pathology of the chest beyond that I have already made in describing the injuries it may sustain in fracture of the ribs, would, I believe, somewhat exceed my province; for the changes produced in the function of the organs it contains, by the pressure of effusions, and the mode of obtaining a diagnosis by auscultation and percussion, are subjects that belong especially to the physician. Very similar phenomena result, however, in aneurism of the aorta; but this is a subject to which I must again refer in its proper place.

Deeply penetrating wounds in the chest are generally so fatal in their character, owing to the vital importance of the organs exposed to injury, that death, particularly in wounds of the heart or aorta, is almost instantaneous.

The abdomen.—No region of the body possesses equal interest with this in the eyes of the surgeon. The number, magnitude, and great importance of the organs contained in the cavity of the abdomen,—their susceptibility to morbid action,—their extensive sympathies,—the varying and complex phenomena that attend their different diseases,—the frequency and danger of injury to them,—and the importance and difficulty in operating in this locality,—all combine to command the strictest attention on the part of the medical practitioner.

In a physiological point of view, we should be almost justified in including the thorax with the abdomen under one common name and description. In mammalia, it is true, the diaphragm constitutes, for the mere anatomist, a definite boundary between the two cavities, but to the physiologist and comparative anatomist this separation appears arbitrary and incomplete; for not only does the skeleton possess no traces of this boundary,—not only, moreover, do we find the separation less and less complete in other classes of the vertebrate animals (so that in many of them the lungs and heart are in immediate contact with the organs of digestion),—not only do we find in all animals an uninterrupted continuity in part of the viscera of the two regions,—but, finally, we notice that the very partition which in the living man separates these cavities, does itself in reality belong equally to both, and is equally subservient to their respective functions. Taking, then, this view of the subject, which indeed physiology so amply warrants, we might advantageously contemplate the hollow of the trunk as one great visceral cavity, considering all its parts and organs, its apparatus of sensibility, of secretion, and even of motion, as alike concerned in the one great purpose of *maintaining the integrity of the blood;* for while the viscera which more particularly belong to the lower compartment regulate the renovation of that fluid with regard to *quantity,* constantly repairing the waste which occurs in assimilation and secretion, those of the upper compartment—the lungs especially—have the power of renewing that peculiar *quality* of the blood by which it is rendered an appropriate source of vitality to the whole living organismus. It is interesting, also, in connexion with this general view of the subject, to compare the mechanical contrivances in the upper and lower portions of this great cavity,—to notice how differently they are constructed in order to facilitate the action of the different organs which they respectively contain, and to contrast the rigid walls and almost uniform capacity of the one, with the yielding parietes and distensible cavity of the other; the thorax being comparatively limited as to the quantity of air it is destined to receive in the function of respiration, while the abdomen is capable of adapting itself both to the varying quantity of food ingested, to the distention in gravid uterus, accumulation of gas in the intestines, fluid in ascites, and in retention of urine.

The abdomen, separately considered, is placed between the thorax and the lower opening of the pelvis; it is bounded above by the diaphragm and the four inferior ribs, to which that muscle is principally attached; below, by the ossa innominata and the muscles that fill up the pelvic openings; behind, by the lumbar vertebræ and muscles of the loins; and laterally, by the four inferior ribs and abdominal muscles. Its external surface presents an oval form, and anteriorly as well as posteriorly it is symmetrically divided by a raphé, which is in no part of the body more distinctly marked than in this region. The convexity of the abdomen on its anterior surface differs according to the various epochs of life, and is subject to changes which depend upon the condition of its internal organs.

This cavity is divided into an anterior, two lateral, and a posterior aspect; but for physiological, pathological, and surgical purposes, and to enable us, indeed, topographically to describe accurately the relative position of its contents, it has been found useful arbitrarily to subdivide it into the following regions: first, by drawing a line from the extremity of the last rib on one side to that on the other, and a second line from the anterior and superior spinous process of the ilium to that on the opposite side, we divide the abdomen into three distinct portions, which must not be considered as a superficial division only, but as extending in a continuous horizontal plane through the cavity. The space between the upper line and the chest is termed the *epigastrium,* and contains the principal organs of chymification and chylification. The intermediate or central space is termed the *umbilical region,* and contains a large proportion of the intestinal canal and the kidnies; while the lower space, termed the *hypogastrium,* lodges and protects the remainder of the intestines, part of the urinary organs, and the internal organs of generation. Even this arrangement has not, however, been considered sufficiently definite to localize with precision the various organs, and a further subdivision is resorted to; for this purpose a vertical imaginary line is drawn on either side, from the junction of the cartilage of the eighth with the seventh rib downwards, to a point slightly external to the spine of the pubes. These two lines subdivide each of the regions already spoken of into three parts. The superior or epigastric region is thus subdivided into a central portion, termed the *scrobiculus cordis,* and two lateral, termed the right and left *hypochondriac* regions. The middle region, in the centre, retains the name of *umbilical,* but its lateral portions are called the right and left *lumbar* regions. The inferior division, or hypogastrium in the centre, is distinguished as the *pubic,* while its lateral portions are termed the *iliac* regions.

Such a subdivision of a continuous surface may at a first glance appear useless and arbitrary; but a little reflection will show how much diagnosis will be facilitated in diseases of the abdominal viscera by these means, and how advantageous it must be to the surgeon, in contemplating the extent of injury inflicted by penetrating wounds, and in performing the numerous operations that appertain to the abdomen, to have the various viscera thus localized, as it were, externally.

Between the muscular parietes of the abdomen and the peritonæum is placed a fascia, which may be designated the internal abdominal fascia; the different parts of this membrane have, however, been named according to the muscles with which it is in contact; but I consider this plan as productive of considerable confusion.

This abdominal fascia is projected from the interior with every vessel and nerve that perforates the walls of the abdomen: the spermatic chord in the male, the round ligament in the female, the crural vessels, are all furnished with prolonged sheaths or coverings of this membrane, which tend to constrict the openings by which these structures issue from the abdomen, and by this constriction prevent the protrusion of the viscera themselves from their natural cavity; this is an anatomical fact which is highly important, from the relation it bears to hernia.

I shall now enter into the consideration of the effects resulting from the wounds and injuries to which the parietes of the abdomen are obnoxious, and shall, in conformity with the general usage of authors upon this subject, divide it into the following heads:—1stly, Simple contusions of the abdominal parietes; 2ndly, Wounds of the parietes; 3rdly, Wounds combined with protrusion of the viscera; 4thly, Wounds of the parietes and viscera; and, lastly, Laceration of the viscera without solution of continuity of the parietes.

In the first class of injuries to the abdomen, viz., simple contusion, the only effect usually produced is the pain inseparable from the accident, requiring nothing more than rest and dietetic observance to restore the patient to health. In some few cases, however, it is authentically recorded that a slight blow of the epigastrium has caused immediate death without any apparent cause being discovered upon post-mortem examination. In such cases death has been attributed by some pathologists to an effect produced upon the centre of the great sympathetic nerve, owing to the relaxed condition of the abdominal muscles, which were unprepared at the moment to offer resistance to the applied force. In other cases collapse results, which may render it extremely difficult to form a just estimation of the extent of the injury. Under such circumstances it is right, gentlemen, to withhold your decision, both as to treatment and prognosis, until reaction has occurred; and perhaps it may be necessary to administer warmth or even slight stimuli to the patient, to produce this effect; and it is only upon the early restoration of reaction, and the absence of relapse, that the surgeon can judge whether the injury consist in simple contusion or is complicated by internal lesion. If, when reaction takes place, the pulse denotes inordinate force, and the temperature of the body is abnormally raised, active antiphlogistic means should be had recourse to, to prevent subsequent peritonitis, which is as much, or more, to be dreaded than the immediate effects of the injury. Abstraction of blood, rest, and a perfectly flexed state of the abdominal muscles, are the means to be employed to prevent this tendency to inflammation; for it must be considered a serious error on the part of any surgeon to permit in such a case inflammatory symptoms to manifest themselves, and be compelled to employ as a remedy those means which he ought to have used as a preventive.

The immediate effects produced by a blow on the abdomen will depend in great measure upon the particular region in which it has been inflicted; and the disturbance to the functions of any organ in that region would sufficiently constitute the diagnosis, and indicate the proper treatment.

Laceration of the abdominal muscles may occur from a blow on the abdomen; blood may be extravasated, or subsequent abscesses may result; each of these effects would necessarily lead to protracted surgical treatment, the diagnosis of the nature of the injury being formed from the concomitant symptoms.

When the parietes of the abdomen are wounded, either by laceration or incision, but the wound is not attended by the protrusion of viscera, there is little difference between the treatment and that already recommended, excepting that in the lacerated wound the parts are to be supported so as to diminish the extent of surface to be healed by granulation; while in the incised wound the edges are to be brought into perfect apposition, and maintained in the proper position by suture, to promote the adhesion of the surfaces; in both cases the abdominal muscles must be kept perfectly relaxed. It is very important, in wounds of the abdomen, to diminish the extent of the cicatrix as much as possible, for if it be large the parietes of the abdomen are proportionably weakened, and the patient rendered liable to hernia. In wounds of the abdomen inflicted by a cutting instrument, it is often difficult to ascertain whether any internal viscus is injured: the surgeon should, however, avoid exploration by the probe, as he may inflict more injury than had been sustained in the original accident. If, from collapse or any other urgent symptom, it appears probable that the intestine is wounded, the edges of the wound should not be adapted with great exactness, but a sufficient opening left to permit of the exit of fæcal matter; purgatives should be avoided, although other antiphlogistic means may be required after reaction has once been completely established. If it should prove that the intestine has not been injured, the external wound, which was at first intentionally left partially open, should be closed, and reparation promoted as rapidly as possible.

A sailor was admitted into Accident ward in 1836, in consequence of an incised wound he had received while "skylarking" with a shipmate. The wound was of three inches in extent, situated in the right iliac region, and upon examination it seemed not to have opened the abdominal cavity. The patient, however, being in a state of partial collapse, probably from the loss of blood, the edges of the incision were not immediately brought into very close adaptation. Reaction soon took place, and as soon as the bowels had been opened, without giving any indication of their having been injured, the wound was completely closed, and it healed most rapidly without the occurrence of a single bad symptom.

A drover was admitted into Stephen's ward, about five years ago, who had been gored by an ox, the horn having entered just below Poupart's ligament, and passed three or four inches into the abdominal parietes. The patient was at first collapsed, and stimuli were required before reaction took place; antiphlogistic remedies were then administered, and poultices and fomentations applied to the wound. The latter was a long time granulating, in consequence of repeated abscesses; but the man ultimately recovered.

When the viscera protrude through the wound in the abdomen, a new consideration arises with regard to the fitness of the protruded viscus to be returned into its natural cavity: it is necessary, therefore, to examine, first whether it is wounded by the instrument which produced the injury to the abdomen; or, secondly, whether it has undergone any change during the period it may have been exposed to the influence of external agents; and whether it be constricted from the smallness of the opening through which it has protruded. Let us suppose that the intestine has not been penetrated and that it is in a fit state to be returned to its natural situation. The restoration should be effected as quickly as possible, the wound through the parietes being enlarged, if necessary, to facilitate the reduction of the protruded part. The edges of the wound are to be brought together and retained by suture; the accident is then to be treated as the second class of injuries to the abdomen, to the condition of which it is, indeed, reduced. Should alteration of colour, abnormal coldness, loss of elasticity, or any other prominent change in the physical or vital properties of the intestine, induce a doubt of the propriety of returning it, the surgeon has then duly to weigh in his mind the probable chances of the restoration of the part, considering the constitutional powers of the patient and the actual conditions of the parts themselves. If, upon mature reflection, any doubt should still remain on his mind, I think it better, as a general principle, to return the intestine into its cavity, as it is there placed under the most favourable circumstances for the restoration of its vital energies.

Caution must, however, be observed when the return of the intestine is determined upon, care being taken to leave the injured portion as near as possible to the wound through the parietes; so that, should nature fail in reparation, a means of exit for the contents of the intestine may be secured. This difficulty in determining on the propriety of returning a morbidly changed viscus into the abdomen often occurs in the operation for hernia; I have frequently experienced it, but can truly say that I have scarcely ever had to regret having returned the intestine, although frequently to regret having left it in the hernial sac. After the intestine has been reduced without any signs of collapse, on the contrary symptoms of increased arterial action (indicated by hard or small pulse) having arisen, leeches should be applied upon the abdomen, and sudorifics and very small doses of calomel with opium prescribed; purgative medicines should, however, be avoided for several days, as a perfect state of rest of the intestine is most likely to promote restoration to its natural condition.

There are many cases on record of viscera, which had protruded through incised wounds of the abdomen, being returned into their natural cavity without any urgent symptoms having supervened. I have met with several such cases in my own practice; and the late Mr. Morgan used to relate a case of a boy at Tottenham, who received a wound in the abdomen, through which the intestines were protruded; the child placed the protruded viscus in his pinafore, and walked some distance to a surgeon, who, having carefully cleansed the bowel from a quantity of adhering dust, replaced it in the abdomen, sewed up the wound by the twisted suture, and in a comparatively short time restored the boy to perfect health.

When the omentum only is protruded, if it has been exposed sufficiently long for adhesion to have taken place at the internal edges of the wound; or if, from the smallness of the opening, there is any difficulty in returning the protruded portions; or, thirdly, if the omentum has undergone any abnormal change; I consider it better that it should be left to slough, rather than that it should be returned into the abdomen: and I have seen cases terminate most successfully under this plan of treatment, adopting the same means as have already been described, to prevent subsequent peritonitis. When it is decided to leave the protruding omentum out of the abdomen, poultices should be applied to it; and when it is in a complete state of slough, a ligature may be placed around it, to promote separation; but before the disorganization is complete, it is better not to remove it, either by ligature or knife, as the former may tend to produce peritonitis, and the latter to cause hæmorrhage.

Accidents such as I have mentioned have been known frequently to occur, in which the peritonæal cavity has been opened, without any ultimate injurious effect; hence it has been inferred by some that the great danger generally attached to lesion of the peritoneum is overrated. The surgeon, should, however, hesitate before he arrives at such a conclusion; learning, from the result of the operation for strangulated hernia, how much more frequently failure depends upon subsequent inflammation of the peritoneum than upon any morbid change which the intestine itself had undergone. It is true, that in the removal of the ovaria—an operation that has lately been frequently performed—many cases have proved successful, notwithstanding the extensive lesions of the peritoneum; but, in my opinion, it is a question whether, in these cases, the peritoneum had not undergone, from the pressure of the tumour, such a morbid alteration as completely to change its specific character, and to prevent that accession of inflammation to which the healthy serous membranes are so prone under injury. It sometimes happens that cases of protruded viscera through wounds in the parietes of the abdomen prove fatal, when the immediate manifestations of injury are not sufficient to account for such a termination. In these cases, death is no doubt generally the effect of concomitant injury to more distant vital parts.

About two years since, a man was brought into Guy's Hospital, in consequence of very severe injuries which he had received while in the act of stealing lead from the top of a brewery, from which he fell. Upon examination, it was found that he had torn open an old scrotal hernia, and that a considerable quantity of intestine had protruded, and had remained exposed for nearly an hour; one of his thighs was also broken, and his left shoulder dislocated. The intestine was immediately returned into the cavity of the abdomen, and the edges of the wound brought together by the uninterrupted suture; the fractured thigh was placed in splints, and the dislocated shoulder reduced; which was accomplished with much more than usual facility, in consequence of the state of collapse of the patient from his abdominal injury. His pulse being feeble, the surface of the body cold, and respiration difficult, julep. ammon. was administered, and bottles of hot water applied to the feet, for the purpose of producing reaction; pain in the abdomen soon after came on, for which leeches were applied, and calomel with opium given, for the purpose of allaying the pain; all the symptoms, however, rapidly increased in urgency, and in fifteen hours after his admission he died.

Upon examination of the body, it was found that he had been the subject of severe peritonitis, demonstrable from the quantity of coagulable lymph which was poured out; the portion of intestine which had protruded had not been ruptured, nor were there any signs by which it could be known from the rest of the intestines, but from a slight degree of thickening, probably from its frequent descent into the old hernial sac. The diaphragm was ruptured, and a considerable portion of the stomach protruded into the chest—a circumstance of which there was no suspicion from the symptoms during life.

LECTURE XXXVI.

CONTINUATION OF SURGERY OF THE REGIONS.

Wounds of the viscera, and of the walls of the abdomen—Symptoms—Penetrating wounds in the epigastrium—Wounds of umbilical and lumbar regions—Wounds in hypogastric region—Iliac regions—Symptoms of wounds of intestines—Treatment—Mode of reparation — Complete division of intestine — Treatment — By suture—By formation of artificial anus—Penetrating wounds of abdominal viscera.

Laceration of viscera without wound of parietes — Symptoms — Treatment—Cases—Distinctive symptoms in rupture of large and small intestine—Rupture of gall-bladder—Symptoms—Rupture of the stomach—Rupture of bladder.

Injuries to abdomen (*continued.*)—When the viscera, as well as the walls of the abdomen, are wounded, the nature of the injury is generally indicated by the peculiar character of the effusion which follows; but sometimes it may happen, either from the oblique direction of the wound, from its small size, or from the emptiness of the viscus itself, that no effusion takes place. In that case the diagnosis must be formed upon the general symptoms that present themselves, and these are indeed usually sufficiently marked to enable the surgeon to form at once a tolerably correct judgment.

There are no circumstances in which the advantage of the topographical division of a region is more evident than in the case of penetrating wounds of the abdomen and its contents; in such accidents the diagnosis is greatly facilitated by the mapping out of the surface; and it is easy to determine upon the organ which has been injured, not only from the effusion which makes its escape, but from the anatomical knowledge of the situation of each particular organ, which would afford the requisite ground for the judgment, even should effusion be completely absent.

Penetrating wounds into the epigastrium are particularly dangerous, owing to the circumstance of the liver, gall-bladder, stomach, duodenum, and, indeed, all the most important of the chylopoietic viscera being situate in this region; and wounds here, if they do not lead to the extravasation of blood, bile, or chyle, would at any rate produce extreme collapse, which would be indicative of injury to some of the organs above named, and the prognosis would be extremely unfavourable, from the importance of their function. In the umbilical and lumbar regions, both the large and small intestines, as well as the kidnies, are liable to be wounded; injury to the latter is not, however, indicated immediately unless the cause be a penetrating wound from the back; in that case a urinous discharge might take place. Wounds in the centre of the hypogastrium may injure the bladder; and if this organ happened to be in a state of distention at the time, the nature of the injury would be indicated by a discharge of urine. In wounds in the iliac region, the iliac vessels are endangered; if the wound occur on the right side, the caput coli, if on the left, the sigmoid flexion of the colon, may be the seat of injury. In a general sense, wounds of the intestines must be considered as dangerous in proportion to their proximity to the pylorus; for even if the patient escape fatal peritonitis in consequence of the effusion of the contents of the wounded intestine, still, with the formation of an artificial anus, as the contents of the small intestines, especially those of the duodenum and jejunum, would be evacuated through the artificial opening, inanition would be a certain result; while, if the discharge took place from the large intestine, the contents of which are almost entirely excrementitious, there would be but little loss of nutrition.

When an intestine is wounded without protrusion, the character of the injury is indicated by blood passing with the stools; and if a small intestine be injured, a further symptom will be the escape of gas, and sometimes chylous matter: and should vomiting supervene, the ejected matters would probably be tinged with blood. Under such circumstances, the patient should be kept in a state of perfect quietude, and as collapse is almost inseparable from such an injury, stimuli may be required to restore reaction; but total abstinence from food must be strictly observed, to maintain that quiescent state of the intestine necessary to its reparation. Constipation may, indeed be permitted to continue for several days, and appears to form part of the means adopted by nature in the restoration of the part to its normal condition.

When the wounded intestine protrudes, its contents may be perceived issuing from the wound, although the opening itself appears to be closed by the protrusion of the internal mucous membrane. The size of this opening, and its direction, as to whether it be longitudinal or transverse, must now regulate the treatment. If the wound be very small, its edges may be pinched up by a pair of forceps, and a thin silk tied round so as to include the whole of the wound; the intestine is then to be returned into the cavity of the abdomen, but must be kept as close as possible to the external wound. The ligature produces a sloughing of all the included tissues, and adhesive inflammation of the peritonæum being set up, an external wall of plastic matter is formed around the dead part, which ulcerates off into the intestine, and is carried away with the fæces. Sir Astley Cooper successfully employed this method of treatment in one or two cases in which the intestine had been inadvertently wounded in the operation for strangulated hernia.

When the opening in the bowel is large, different kinds of stitches are used to keep the edges in apposition. The uninterrupted suture, however, or glover's stitch, is, I believe, the best, but the finest procurable needle and silk must be employed; and after the bowel has been returned into its natural cavity, the same precaution as I have already mentioned to keep it in proximity to the external wound, should be adopted. When the intestine has been completely divided by a transverse wound, various plans have been recommended for re-establishing its continuity. For this purpose, some animal substance of a cylindrical form, such as the trachea of a sheep, has been introduced. This serves as a sort of mould, and enables the surgeon to keep the edges of the severed bowel in juxtaposition during the application of the suture, the foreign animal substance easily passing away afterwards with the stools. Some have recommended that the upper extremity of the intestine should be passed into the lower, and that a ligature be then applied around the whole. This produces contact of the peritonæal coat of the intestine above and below the ligature, and as adhesive inflammation is set up, an effusion of plastic matter soon covers the ligature, and re-establishes the continuity of the external part of the canal; the ligature itself, and the constricted portion, ultimately sloughing off internally, and being conveyed away with the excretions. It has been objected to this operation, that, in bringing the severed ends of the intestine together, a serous is presented to a mucous surface, and that these two structures are not fitted for union; but it is not intended in this operation that they shall unite: the union is caused by the effusion of the plastic matter from the external surfaces above and below the ligature, and from serous to serous membrane, the whole of the intestine included in the ligature being destroyed, and sloughing away. M. Jobert has proposed, as an improvement in the above operation, to invert the inferior extremity before the superior is introduced. In that case, two serous membranes are brought in contact, and the union may take place at once between them; but, under these circumstances, the invaginated portion would not be included in a ligature, but retained in position by suture.

After all, however, judging from the result of the experiments, it remains questionable whether, in complete division of an intestine by a transverse wound, it is not better to establish an artificial anus and leave nature to her own efforts for the ultimate restoration of the patient; and this does not indeed appear to be so difficult a process as may be supposed, particularly if nature be judiciously assisted by the art of the surgeon.

Almost immediately after the divided intestine has been replaced in the cavity of the abdomen, an adhesive inflammation shuts out its open extremities from the peritonæal cavity, so that after a few hours have elapsed, the stitch employed to secure the wounded intestine near the external wound in the abdomen, may be removed, and as soon as the feculent matter passes partly through the latter, the patient may be considered safe, as far as refers to the danger of extravasation of the fæces into the abdomen. But as the formation of an artificial anus renders the patient loathsome to himself, and unfitted for the social state, subsequent means must be adopted to re-establish the integrity of the intestinal canal.

With this view, one of the first steps is to diminish as much as possible a tendency which the upper portion of the bowel has to prolapsus or eversion of its mucous membrane; and this object may be attained by keeping the fæces in a semi-fluid state, and by maintaining slight pressure upon the extremity of the protruded part. The lower portion of the intestine is liable to contract at its extremity, so that the ready passage of the contents of the upper portion is prevented from passing into the lower; this may be in some measure obviated by the use of enemata, which stimulate the natural action of the bowel, and prevent it from falling into the abnormal condition always produced by disuse. The strictest attention to cleanliness of the external wound should constantly be observed, otherwise the presence of the feculent matter will interfere very materially with the progress of the healing process. As the wound goes on uniting, it gradually contracts into a narrow fistula; this contraction is still further promoted by gentle pressure; and after a while, as the fæces meet with some resistance in the direction of the wound, they acquire a tendency to pass on through the natural passage, a change which is first indicated by the escape of flatus and mucus per anum; upon which, enemata should be freely employed to re-establish the natural function of the rectum and anus.

By such treatment, a recent artificial anus may very generally be cured, but if neglected, the lower part becomes so much retracted, and at the same time contracted, as to render the cure almost impossible. Dupuytren has, however, proposed the removal of the obstruction termed the "Eperon" by means of a pair of forceps made to include it, one blade of the forceps being inserted into the upper, the other into the lower opening of the intestine, and being closed with sufficient force to produce sloughing of the included valvular portion, after which a free communication between the two parts of the intestine will be re-established. The same attention must be paid to the external wound as under the circumstances I have before described.

In gun-shot wounds, where the ball has penetrated the parietes of the abdomen and wounded a viscus, nature has sometimes effected the reparation of the part, the ball passing away with the fæces. A musket-ball has also been known to penetrate and lodge in the urinary bladder, from which it has afterwards been removed, encrusted with calcareous matter, the patient ultimately recovering.

Mr. Travers has written an excellent work, detailing the results of different modes of treatment of wounds of the intestines in the lower animals; and I cannot do better than to strongly recommend it to the perusal of every medical student.

Laceration or rupture of the viscera of the abdomen may occur without lesion of the external walls, indeed, without the abdomen itself receiving any blow: in a fall from a height, for instance, the concussion alone may be sufficient to cause rupture of a viscus, as of the liver, which, from its great weight and peculiar consistence, is particularly liable to be rent from such a cause. The spleen and kidnies are liable to similar lesions, and when distended, the intestines and urinary bladder may also give way without any external wound. In all these cases, collapse forms the principal symptom; and the danger may be considered as proportionate to the extent and duration of the prostration of the patient. In the treatment of these accidents, the first object is to place the patient in a warm bed, to assist in producing reaction; and if that should not be sufficient, bottles of hot water must be applied to the soles of the feet; and if necessary, internal stimuli administered. Hot fomentations, or a thinly-spread poultice, should be applied over the whole extent of the abdomen; and if, when reaction is produced, pain, accelerated pulse, and elevation of the temperature of the body, indicate inflammation, blood must be taken, either from the arm, or by means of leeches from the abdomen. Small doses of calomel and opium may be ordered, taking care that there is enough opium to prevent the purgative effect of the calomel: I usually prescribe a grain of each every six hours. It should be remarked that in peritonitis the pulse is always small; and it is its hardness and incompressibility which constitute its specific character; it being only after bleeding that it becomes softer and fuller.

Collapse is equally attendant upon the rupture of the solid and hollow viscera, and it is therefore difficult to form from this symptom a diagnosis as to the particular organ that has sustained injury: the judgment may, however, be guided in some measure by noticing the precise point at which the pain is chiefly felt, and by the locality in which the injury has been inflicted. When it is supposed that the liver or spleen is the seat of the mischief, we must not be too eager to restore the patient from the state of collapse, as that is the most favourable condition for checking the hæmorrhage inseparable from the lesion of these organs; and as the intestines might have been ruptured at the same time, the patient should, as far as possible, be kept from food for a few days, in order to preserve the alimentary canal in a quiescent state; for in all these cases the greatest danger arises from extravasation of blood, or the effusion of the contents of the bowels into the abdominal cavity, producing peritonitis.

T—— H——, æt. 21, was admitted into Accident ward in October, in consequence of an injury he sustained from a loaded waggon passing over his loins. The person who accompanied him stated that he spat blood on his way to the hospital. When admitted he was in a state of extreme collapse; his pulse was small, weak, and labouring; breathing frequent and difficult; countenance pallid, and expressive of great anxiety; and the surface of the body quite cold. He still spat at intervals mucus tinged with blood; and complained of constant pain throughout the whole epigastric region. No fracture of bone could be detected.

He was put to bed, and bottles of hot water applied to the feet, and fomentations to the abdomen. At 8, P.M., his pulse was 100, small, feeble, and fluttering: as he had not passed his urine since his admission into the hospital, the catheter was used, and six ounces of water tinged with blood drawn off: his bowels were also evacuated during the evening, and he passed a grumous stool, but no clear blood; he was extremely restless, and unable to remain for a minute together in the same position, although at the same time motion greatly increased the pain. At 11, P.M.; pulse still 100, but altered in character, being now contracted and wiry, indicating loss of blood. He also complained of a sensation of fulness and heat on the left side of the abdomen. The next morning all the symptoms were aggravated; but he lingered until evening, when he died.

Upon examination of the body, a pound of blood was found in the abdomen. This at first appeared to be the result of laceration of the left spermatic vein; but, upon further examination, it was found to have proceeded from the spleen, which was ruptured, and, indeed, a portion was torn from its upper and posterior surface. The diaphragm was ruptured a little above the œsophageal opening, and there was an effusion of blood between the liver and peritonæum, the former being lacerated; the kidnies were also separated from their peritonæal covering by an effusion of blood, but as there was no lesion of these organs, the blood had probably reached its situation by gravitation; the stomach, intestines, and bladder, were in a natural condition; but the inferior part of the left lung was much altered in appearance, and gorged with blood.

A boy, aged eight years and a half, was admitted into Guy's Hospital, in consequence of a severe injury he had sustained from a blow on the abdomen. His father stated that the boy was "minding his truck," when a waggon heavily laden drove against the wheel of the truck, and swung it round with considerable violence; the handle striking the boy just at the junction of the cartilages of the eighth and ninth ribs, forcing him against the post of the gateway, into which he had drawn his truck to get out of the way of the waggon. Immediately after the boy had received the blow he fell, but was able to rise and walk a few steps; he again, however, fell, upon which he was conveyed to a surgeon's, who, finding him in a state of collapse, gave him some stimulant, and sent him to the hospital.

At the time of his admission, nearly an hour after he had received the injury, he showed great anxiety and pallor of countenance; coldness over the whole surface of the body; and some pain in the abdomen, which was not increased by pressure; his pulse could not be felt, but the heart's action was perceptible, although it was beating very feebly. He was immediately put to bed, wrapped up in blankets, bottles of warm water applied to his feet, and friction used to restore the warmth of the body. A small quantity of julep ammoniæ was also administered. Under this treatment he seemed somewhat to rally, but only for a few minutes, when he relapsed into his former state of collapse. Upon now being asked if he suffered, he said the "pain in his belly increased." He died half an hour after his admission.

Twenty-four hours after death, his body was examined. Externally there was evidently some slight ecchymosis near the external extremities of the seventh and eighth ribs on the right side, and opposite to the last two ribs on the left. On opening the chest nothing particular was observed; but upon inspecting the abdomen, it was found to contain a very large quantity both of coagulated and fluid blood, which proceeded from the left kidney, the upper portion of which, above the renal vessels, was torn from the lower part, which remained in its natural position. The fluidity of the blood probably depended upon its admixture with urine. There was some ecchymosis on the liver, opposite to that on the chest, so that it appeared as if the kidney had been lacerated by the *contre-coup*, owing to the boy's back being driven against the gate-post: the liver was merely bruised, and the rest of the viscera were uninjured.

In consequence of the great depth at which the kidnies are situated, their rupture is an accident of comparatively rare occurrence; and the diagnostic marks are rather difficult, particularly at first, until indeed bloody urine, and the situation of the pain, indicate the nature of the injury. The treatment in these cases, as in the injuries of the abdomen, is to prevent or subdue peritonæal inflammation, and this can only be effected by the strictest antiphlogistic means. In the foregoing case, however, collapse prevented the possibility of such treatment being adopted. It is evident that the cause of death was the extravasation of blood into the cavity of the abdomen, producing that degree of irrecoverable prostration, which is so strong a mark of injury to the abdominal viscera.

About five years ago, I was sent for to see a gentleman, who, in stepping on board a steam-boat, fell partly down a trap-hatch on the deck. In falling, he struck his loins violently against the edge of the opening; he immediately felt very sick, was attacked with severe pain, and was obliged to be carried home. I saw him about six hours after the accident; there were no signs of collapse; but he was still in very great pain, and in two attempts to make water had voided little else than blood. I immediately took twelve ounces of blood from the arm, and had eight ounces removed from the loins by cupping. I ordered a grain of calomel, and half a grain of opium, every six hours; and as there was sufficient evidence that the intestinal canal was uninjured, I prescribed acidulated saline draughts. The patient continued to pass bloody urine for several days; he suffered also from pain along the course of the ureters; and when this symptom had ceased, he continued to experience considerable pain in the region of the kidnies, particularly of the right kidney: the pain was much increased by motion. A blister was applied on the right loin, and the cupping repeated: under this treatment he was soon considerably relieved. The urine improved in colour, and a greater quantity was also passed; the pain in the loins was diminished, and in six weeks he became quite convalescent. There can be no doubt that in this case the right kidney received great injury, probably lesion, but not to a sufficient extent to admit of extravasation of urine, and by perfect rest the mischief became ultimately repaired.

The solid viscera are, as we should naturally suppose, more liable than the hollow to rupture from a blow on the abdomen, without the lesion of its parietes. Rupture of the hollow viscera sometimes occurs, however; and I have seen many instances in which the intestines, and some few in which the urinary bladder, have been thus injured. The symptoms arising from rupture of an intestine without lesion of the abdominal parietes, might lead to the supposition that the diagnosis in such a case would be somewhat difficult. Such is not, however, the fact; as there are always sufficiently marked characteristic points to enable the surgeon to judge accurately of the nature of the injury, and to decide with confidence on the proper mode of treatment. In this kind of injury, as well as in penetrating wounds of the intestine, collapse is the immediate effect; and in this stage, it may be necessary to administer stimuli to produce reaction. Antiphlogistic means should next be employed, to subdue the slightest tendency to peritonæal inflammation; but purgatives must be strictly withheld, as the constipation which invariably follows these injuries must be regarded as part of the curative means adopted by nature for the purpose of ensuring a perfect state of quietude of the intestine during the progress of the reparative action. A patient has often been destroyed by the too hasty administration of purgatives in these cases, the surgeon having mistaken constipation for the disease, when, in fact, it is the condition most essential to the curative process. Physicians are constantly meeting in practice with cases of chronic ulceration of the intestines, particularly of the cæcum, in which constipation, attended by more or less fixed pain, forms a very prominent feature. In these cases, no practitioner ever thinks of giving purgative medicines, but hails the quiescent state of the bowels as the surest indication of the restorative action which nature has established. After the operation for strangulated hernia, also, no surgeon who is well acquainted with the principles of his profession would dream of prescribing purgatives, but would leave nature to her own resources; confident that the bowel would be evacuated when the injured portion became again competent to the performance of its natural functions. It has indeed, in my opinion, seldom, if ever, occurred, that a patient died of mere constipation, without some irrecoverable disorganization had gone on in the course of the intestinal canal.

Whether it be a small or large intestine which is ruptured may be partly judged of by the situation in which the greatest pain is experienced, and partly by the urgency of the sickness produced; for when the small intestines are the seat of the injury, vomiting, as well as constipation, constitutes an early and important symptom; while in lesion of the large intestine, constipation and swelling of the abdomen form the most marked feature of the accident, and the vomiting does not come on until a more advanced period in the progress of the symptoms.

The gall-bladder may be ruptured by a blow upon the abdomen, and this is immediately followed by collapse, sensation of coldness on the surface of the body, and deep-seated heat through the whole interior of the abdomen. Sickness soon comes on, ushered in by rigor, and the patient generally sinks a few hours after the accident, death resulting from effusion of bile into the peritonæal cavity. Rupture of the stomach leads to very similar results; but vomiting of its contents, mixed with blood, forms a distinctive diagnostic mark. When the urinary bladder is ruptured, if the lesion involves any portion covered by peritonæum, death rapidly follows the injury, and medical treatment is completely unavailing, as the patient dies without rallying from the state of collapse, and, consequently, antiphlogistic means cannot be had recourse to. But if the bladder be ruptured, so that the extravasation of urine takes place exterior to the peritonæal cavity, the vital powers are not to the same degree affected, and active means may prevent inflammation from following. The urine should be drawn off from the bladder, to prevent any accumulation which may possibly occur, notwithstanding the rupture of the organ; and an opening should be made in the perinæum, even through the deep fascia, if there be any indication of urine being extravasated between the bladder and rectum. Several cases are recorded, in which individuals have completely recovered after such an accident, where the rupture has been external to the peritonæum; and, indeed, even where that membrane has undergone lesion, there may be reasonable hope of recovery, if the quantity of urine extravasated be not large, and judicious means be employed to prevent or subdue peritonitis.

LECTURE XXXVII.

CONTINUATION OF SURGERY OF THE REGIONS.

Continuation of abdominal region—Epigastric region—Abscess of liver—Distention of gall-bladder—Scirrhus of the pylorus—Case—Aneurismal tumours—Hypertrophy of the spleen—Case—Adhesions between duodenum and liver — Umbilical region — Urinary discharge from umbilicus—Case—Umbilical tumours—Obstruction in the intestines—Its causes—Surgical operation for relief of — Question as to its admissibility — Abscess in the lumbar region—Case—Hypogastric region—Surgical importance—Disease of the sigmoid flexion of the colon—Inguinal canals—Their liability to morbid changes—Arrest in descent of testicle—Anomalous symptoms — Cases — Varicocele — Treatment—Hydrocele of spermatic chord—Difficulties in diagnosis—Treatment—External iliac artery tied in this region—Pubic region—Removal of diseased ovaria—Greater and minor operations — Comparative danger — Puncturing urinary bladder — High operation for stone.

I HAVE up to this point described the pathological considerations resulting from lesions occurring from without to within—that is, from the parietes towards the cavity of the abdomen; but there are many diseases which take their rise within the cavity itself: these sometimes require surgical as well as medical treatment; and it will be found that in them, as well as in cases of injury from violence, the strict observance of the system of regional division will afford great facility in the formation of diagnosis.

In the epigastric region, for instance, tumours are often formed, the true character of which must be judged of rather by the disturbance they cause in the functions of the important organs contained in this part, than by the physical constitution of the tumour itself. A fluctuating tumour may, for example, present itself in the right hypochondriac region concomitantly with great disturbance to the functions of the liver; and in such a case it would be almost impossible, without strictly investigating the history of the complaint from the very first symptom, to distinguish distention of the gall-bladder from abscess in the liver. This is, however, very important, for if, under these circumstances, a mistake should be made, and the gall-bladder punctured instead of an abscess, there would be great risk of extravasation of bile into the peritonæal cavity, which would be certain destruction to the life of the patient.

It is not my province to detail the symptoms in cases of this kind; but I feel it right to warn the student against interfering with them, or the most unfortunate consequences may ensue. Another description of tumour is sometimes formed in this locality; it is situated just at the junction of the scrobiculus cordis with the right hypochondriac region, and can generally only be felt by pressing the finger upon it with some force, the pressure producing an aggravation of pain. This tumour is usually attended by vomiting, which takes place an hour or two after eating; it is also sometimes accompanied by pyrosis.

The patient is generally past middle life when the disease manifests itself, and betrays more emaciation than positive suffering: this is scirrhus of the pylorus—an affection which invariably proves fatal. On the day of the coronation of George IV., Sir Astley Cooper and myself went to the house of a lady to witness the procession; while standing together at the window she cursorily mentioned to Sir Astley that she always felt sick and began to vomit about an hour and a half after eating. Sir Astley requested her to allow him to examine her, and when, after being absent a few minutes, he returned to me, he said, "Mrs. C. will not be alive this day three months." Before the expiration of that period she was dead. Such a case does not come frequently under the notice of the surgeon, but at the same time it is quite necessary that you should know something of the physical characters of the disease, in order that you may, from the recital of certain symptoms, be able to perform those examinations upon which your diagnosis must be founded.

Aneurismal tumours are not unfrequent in the epigastric region, and they may so far interfere with the functions of the stomach as to induce the supposition that that organ is diseased. Its disorder is, however, only secondary, proceeding from the tumour: hence it becomes of the highest importance to make a minute and careful examination, when such anomalous symptoms present themselves. In the left hypochondriac region, a large tumour is sometimes formed by hypertrophy of the spleen; this often follows protracted intermittent fever; it interferes materially with the functions of both stomach and liver—a circumstance not to be wondered at, when we consider that the spleen, stomach, and liver, all derive their blood from the same branch of the aorta. Cases have occurred in which the spleen has become separated from the diaphragm and stomach, and even descended as low as the left iliac region. The late Dr. Babington has described a case of this kind, which occurred in his practice. Enlargement of the spleen is not, however, so frequent a disease as is supposed, as encysted tumours of the ovaria are sometimes mistaken for it. I remember being once present in consultation with Sir Astley Cooper and Sir Charles Clarke, on a case of ovarian dropsy, in which, after I had drawn off the fluid, Sir Astley Cooper directed our attention to a large tumour, which was rendered distinguishable from the flaccid state of the abdominal parietes after the removal of the fluid. Sir Astley remarked that he had never before seen the spleen so completely retain its form under such a great increase of size. Sir Charles Clarke replied that he did not believe it to be the spleen, as he had never known it to be enlarged in ovarian dropsy. About six weeks after, the patient died, and a post-mortem examination showed Sir Charles Clarke's opinion to be correct, as the tumour consisted of an abnormal growth from the diseased ovarium. I mention this case, as I consider it illustrative of a very important fact connected with the pathology of ovarian disease.

In obstinate cases of jaundice, deeply-seated tumours are sometimes formed in the epigastrium, generally in the neighbourhood of the junction of the cartilages of the seventh and eighth ribs. These tumours are not unfrequently the result of adhesion between the duodenum, the liver, and Glisson's capsule, interfering with the passage of the bile from the liver to the duodenum. When the patient presents a greenish-coloured complexion, I always suspect that the pancreas is involved in the disease, and I then examine the region of that viscus with great care, to ascertain if there be any perceptible enlargement of the organ.

In infancy it is not uncommon for a urinary discharge to take place from the umbilicus, in consequence of the open state of the urachus: in such a case you should first ascertain that there is no obstruction to the passage of the urine through its natural canal, and if that should be the case, as frequently happens from congenital phymosis, the cause of the obstruction should be removed, and then, upon gentle continuous pressure being applied to the umbilicus, the urachus generally closes; although there have been instances in which the defect was never remedied.

Some years ago I admitted a patient into Guy's Hospital who had been for many years suffering from stricture of the urethra; and in consequence of frequent attacks of retention of urine, his bladder had become so much enlarged as to rise into the umbilical region. From the history of the case, it appeared that during one of these attacks he was seized with peritonitis, which required prompt antiphlogistic means to subdue it; external inflammation around the umbilicus, with a deep-seated pain in the bladder, supervened upon the peritonitis. In a few days a small abscess burst in the umbilicus, and urinous discharge followed; indeed, when he was admitted into the hospital, he passed as much urine by the umbilicus as by the natural passage.

The plan I adopted for his relief was to fasten an elastic gum catheter in the bladder, for the purpose of keeping the urine constantly flowing, so as to prevent any accumulation in the bladder; but as the constant pressure of the instrument caused great pain and irritation, I changed my plan, and ordered his urine to be drawn off four times a day: he soon became expert enough to do this himself; when, unfortunately, one day the catheter broke while being withdrawn, and a third of its length was left within the bladder. A fresh train of symptoms resulted from the presence of this substance; and after trying, unsuccessfully, every means I could think of for its removal, I was obliged to perform an operation similar to that of lithotomy: the patient soon recovered; and I then redirected my attention to the original complaint, which remained unrelieved. I resumed the plan of frequently drawing off the water, and proposed to endeavour to close the opening by a plastic operation: this was consented to, and I performed it by paring the edges of the fistula, and drawing over a portion of the neighbouring skin, which was accurately adapted, and firmly secured by suture; unfortunately, peritonæal inflammation set in, however, and the patient died. This case is not only remarkable from the discharge of urine through the umbilicus taking place without any congenital malformation, but it is also important from the circumstance of peritonæal inflammation following the operation itself, or arising from the irritative influence of the sutures: at the same time, it is clear that the constitution of the patient had not been much deteriorated by the original disease, as the operation of removing the catheter from the bladder was attended with so little disturbance to the general health.

Tumours sometimes form in the region of the umbilicus, from protrusion of viscera; these tumours constitute what is termed umbilical hernia. A general distention, with a fixed pain in the umbilical or lumbar regions, may, however, result from some obstruction within the intestinal canal; such a condition produces constipation and sickness, and it is only from the local tenderness, and the history of the case from its commencement, that the exact seat of the disease can be ascertained: if vomiting be the prominent feature, the obstruction may be referred to the small intestines; if constipation and tympanitis, with slight vomiting, only be present, the obstruction is, in all probability, in the large intestine: in either case, if the symptoms do not yield to remedies, it becomes a question whether abdominal exploration is not justifiable. It sometimes happens, that the small intestines become strangulated by a band of lymph thrown out from the mesentery, or by a portion of one intestine passing under a band of adherent matter connecting two other portions to each other: nothing but the liberation of this constriction can restore the patient to health; but it is doubtful whether any operation is admissible, as it is impossible to tell the exact point at which the obstruction exits; still, as the exploration offers the only chance of relief, we ought perhaps to be careful how we hesitate to make the attempt. The obstruction may also occur from intus-susception of a portion of intestine; if the operation of exploration were resorted to, under such circumstances, there would not only be the difficulty of discovering the point at which the lesion existed, but there is great doubt whether, in a protracted case, the parts, when restored to their normal form, would be competent to perform their natural functions. Even if the operation should be determined on, the greatest difficulty appears to me to lie in deciding upon the proper moment at which it may be performed with least risk; for although little chance of success exists if it be delayed, yet no one would venture upon it while there remained the slightest probability that nature would herself effect the removal of the obstruction. When, from protracted constipation, produced by obstruction in the large intestine, the ascending or descending colon becomes distended, the situation of the obstruction may be generally discovered by a peculiar dull sound upon percussion; the dulness being below if the obstruction be in the ascending colon, and above if in the descending. In cases in which the constipation is insuperable, the colon should be opened, and its contents evacuated by establishing an artificial anus in the loins. This operation is performed by making an incision, about three inches in length, between the last rib and the ilium, and about two and a half inches from the spinous processes of the lumbar vertebræ: this incision is to cut through the skin and mass of lumbar muscles, so as to expose the quadratus lumborum muscle, which is to be divided, when the internal layer of the fascia lumborum will be exposed; that being cut through, the colon, uncovered by peritonæum, is presented to view: it may be easily opened, and its contents evacuated.

Some surgeons have maintained that this operation is inadmissible, owing to the difficulty of its performance without injury to the peritonæum; but I am disposed to believe that this danger is much exaggerated, and that if the part of the intestine exposed be the exact seat of obstruction, and the intestine distended to its utmost, it may be easily opened without risk of wounding the peritonæum, as, in the natural condition, the posterior fifth of the descending colon, from the termination of the arch to the crest of the ilium, is uncovered by peritonæum, and when abnormally distended, a much larger surface is left exposed. My colleague, Mr. Hilton, has performed this operation upon subjects in whom death had been caused by insuperable constipation, in consequence of obstruction of the lower portion of the colon, and he found no difficulty whatever in opening the colon between the last rib and the ilium, even without experiencing any obstacle in avoiding the peritonæum. He has also once performed this operation on the living subject, but unsuccessfully, although he had no difficulty in avoiding the peritonæum. M. Amussat recommends a crucial incision to be made in exposing the intestine, so as to secure sufficient room for its more complete inspection; but such a precaution seems scarcely necessary, and at all events should not, I think, be resorted to, unless it appears requisite as the operation advances. It has also been said that there is some difficulty in recognising the bowel, even when it is really exposed; but I cannot understand how such a difficulty can occur; for in the space between the last rib and the ilium, and anterior to the quadratus lumborum muscle, nothing but colon can present itself to view, and it may be easily recognised by the band of longitudinal fibres which are exposed. Some caution is necessary in the division of the quadratus lumborum itself, which should be carefully dissected through, almost fibre by fibre, to avoid the possibility of dividing the anterior layer of the fascia lumborum; the latter should not be cut through until it is perfectly exposed by the removal of the muscle, as it constitutes the precise boundary to the cavity of the abdomen, and furnishes an infallible means of recognising the point to which the operation has advanced; upon laying it open, nothing but the colon can be seen, unless, indeed, the kidney occupied the space, which could only be the result of disease in that viscus. M. Baudens considers that he has arrived at a certain mode of distinguishing the colon from the kidney when a doubt arises, his plan being the introduction of a very small trocar or canula, which, if it penetrates the colon, would lead to the escape of gas, and the soiling of the instrument with fæces; while if the kidney were punctured, blood, perhaps mixed with urine, would flow from the canula. The treatment of the artificial anus is the same in this as in other cases in which it may be formed. As the obstruction in the colon usually results from malignant disease, the operation can only act as a palliative; but the prolongation of life, even for a few months, would be a sufficient boon to warrant its being undertaken.

Abscesses in the loins may sometimes require to be opened in this region: they may be produced by disease of the spine, and then constitute what are termed lumbar abscess, or they may arise from disease in the kidnies. I once saw Sir Astley Cooper open an abscess in the loins, and remove from it a urinary calculus, which, judging from the history of the case, had doubtless passed from the kidney or ureter by the process of ulceration, the stone acting as an extraneous body in the surrounding tissues.

The hypogastric region.—This is perhaps more frequently the seat of surgical operations than any other region of the abdomen: it contains the ileum, which, owing to its slight attachment by means of the mesentery, as well as from the existence of the natural outlets through the parietes of this portion of the abdomen, is very subject to protrusion: it also contains the termination of the ileum, with its somewhat complicated apparatus in the right iliac region, and the termination of the sigmoid flexion of the colon in the rectum, in the left iliac region, in both which localities these viscera often become the seat of disease. The urinary bladder and part of the internal organs of generation occupy the pubic region, and these often require surgical operations for the relief of the diseases to which they are subject. The lesions which so frequently occur at the termination of the ileum in the cæcum, in consequence of the disorganization of the ilio-colic valve, often lead to an affection termed "ileus," which requires similar treatment to that described as necessary in protracted constipation from disease in other parts of the colon. This is, however, more dangerous, as the small intestines are implicated. The disease may be distinguished, from the circumstance of the pain being constantly referred to one spot in the right iliac fossa, where a fulness may generally be felt.

Although but little is known of the natural function of the vermiform process of the cæcum, it is proved beyond question, that any alteration in its organization produces great disturbance throughout the whole length of the colon. The intrusion of foreign bodies—its adhesion from inflammation—its protrusion from its natural cavity, so as to form a hernial tumour—all produce very urgent symptoms, of which the immediate cause is, however, discovered with great difficulty; as the symptoms are are all referrible to the altered action of the colon, in which disease from any other cause would produce a like effect.

In the left iliac fossa, a tumour of considerable size is sometimes formed by an accumulation of fæces in the sigmoid flexion of the colon. This accumulation is usually attended by pain, and by enlargement of the veins in the left lower extremity, in consequence of the pressure of the sigmoid flexion of the colon on the left iliac vein. In such cases, copious enemata are indicated, for the purpose of softening the indurated fæces; castor oil is the best purgative for emptying this portion of the intestines.

Malignant disease often attacks the colon at the point of its termination in the rectum. This may produce so determined an obstruction to the passage of the egesta, as to lead to the necessity for opening the colon, as already described.

The inguinal canals situated in this region, and which contain the spermatic chord in the male, and the round ligament of the uterus in the female, are very liable to abnormal changes, which require some acumen on the part of the surgeon to ascertain their exact character. The most frequent of these changes consists in the swelling produced by the protrusion of an intestine; but a swelling may also occur here from the presence of a testicle not descended into the scrotum, from a varicose state of the spermatic veins, or from a hydrocele of the spermatic chord: each of these cases would require totally different treatment, and, therefore, it becomes highly necessary to diagnose them correctly. When the tumour is suspected to arise from the presence of a testicle in the inguinal canal, the absence of the testicle from the scrotum would be strongly corroborative of the accuracy of the supposition; and further proof may be obtained by pressing the tumour, when, if a sensation be felt similar to that experienced in compressing a testicle in its normal situation, there can be but little doubt of the true character of the swelling. In young people, the most anomalous symptoms sometimes arise in cases of non-descended testicle. A youth, the son of Colonel R., was brought to me, suffering from symptoms similar to those in case of calculus passing along the ureter. I prescribed the warm bath, with calomel and opium, but without success. I then made an examination of the abdomen, and discovered the left testicle situated within the inguinal canal, close to the external abdominal ring. I at once perceived that this condition of the testicle was the probable cause of the constitutional irritation, and considered that if I could contrive by any means to ensure its descent, I should be able to afford immediate relief to the patient.

For this purpose I had an instrument constructed by Mr. Bigg, by which I was enabled to keep the scrotum elongated, and thus to produce a constant tension of the gubernaculum, and establish a tendency to draw the testicle downwards. At the same time I placed a weak truss on the inguinal canal above the testicle; and this produced a good effect in two ways—preventing the descent of the intestine into the inguinal canal, and also pressing the testicle downwards towards its normal situation: this plan of treatment proved perfectly successful, and, in the course of a fortnight, the testicle had completely descended, and the patient was entirely relieved from the symptoms which had previously caused him so much distress. I have since had a similar case in Guy's Hospital, the result being equally successful. In that instance, however, I did not make use of any mechanical contrivance to keep the gubernaculum on the stretch, but drew and kept the scrotum down to the thigh by pieces of adhesive plaister only.

A varicose state of the veins of the spermatic chord within the inguinal canal produces many physical signs that closely resemble hernia: such, for example, as the facility with which the tumour seems to recede into the abdomen under pressure, its diminution in size when the patient is in the recumbent posture, and its expulsion on coughing. The perfect absence, however, of any derangement of the bowels would excite a doubt as to its being a hernial swelling, and the diagnosis may readily be determined by maintaining pressure on the internal ring. After the tumour has been reduced, if it be hernia, it cannot return; but, if varicocele, as the pressure prevents the return of blood, the tumour soon reappears, its size increasing according to the firmness of the pressure, and the length of time it is kept up. Hydrocele of the spermatic chord within the inguinal canal, forms a tumour, which may be very easily mistaken for an irreducible hernia. I have known surgeons of great experience fall into this error; and, indeed, unless the tumour be transparent, it is only by negative indications that the two can be distinguished from each other; the absence of any functional derangement in the bowels, and want of continuity with the internal ring, (it being indeed, perfectly circumscribed and isolated,) form its principal distinctive characters. Before, however, any curative means be adopted, it would be a safe course to explore for fluid with a fine grooved needle: if it be proved to be hydrocele, it may be cured by introducing a seton of one thin thread of silk, or by, what I consider a safer plan, merely laying open the sac, evacuating the fluid, and applying the pressure of a weak truss, to prevent its reaccumulation.

In cases of wounds or aneurism, the external iliac artery is tied in this region: it is also in the pubic portion of the hypogastric region, that the incision is made for the removal of diseased ovaria —an operation which of late years has come much into vogue. Some surgeons recommend, indeed, that the incision should reach in the course of the linea alba nearly from the ensiform cartilage of the sternum to the pubes. I have once performed this operation, and, although no untoward circumstances occurred during the operation itself, the patient sunk in twelve days, never having, indeed, rallied from the depressing influence apparently induced by laying open the epigastrium. I have always attributed the dangerous effects to the exposure of this region, as during the whole period of her suffering the patient referred the sensation of pain and sinking to it.

"The minor operation," in which the diseased ovarium is exposed by making an opening of three or four inches in length between the pubes and umbilicus, is in my opinion by far the more admissible. I have seen it performed twice, with complete success, by Dr. Frederick Bird, and have no doubt that, in well-chosen cases, it would often prove successful. As to the operation itself, it requires but little manual dexterity or anatomical knowledge; but in the preparation of the patient, and after-treatment, the greatest judgment is requisite. The chief danger does not, however, appear to arise from peritonitis; for either the peritoneum has undergone such change from the effect of the disease, or the impression made by the operation on the vital powers is too severe to admit of the usual inflammatory action supervening; and in unsuccessful cases, the patient seems to sink from extreme prostration, rather than from increased arterial action. With respect to this operation, however, we are not yet in possession of sufficient data as to the result of operations already performed, to be enabled to judge of the propriety of its adoption.

In the pubic region, the urinary bladder is sometimes punctured with a trocar, and it is in this locality also that the high operation for the stone is performed. These operations will, however, be described when I speak of the region of the perineum, and of the urinary and genital organs.

LECTURE XXXVIII.

HERNIA.

Definition of—Hernia may proceed from either of the natural cavities—Hernia of the brain—Of the lungs—Classification—Case—Diagnosis—Prognosis—Treatment—Abdominal herniæ—Classification—Frequency of herniæ—Coverings of abdominal hernia—Intrinsic and extrinsic—Species of hernia—Inguinal—Femoral—Umbilical—Ventral—Obturator—Ischiatic—Perineal—Vaginal and pudendal herniæ.—Contents of a hernia—Diagnosis from symptoms—Hernia of the bladder—Causes of hernia, predisposing and exciting—Form of tumour—Conditions of herniæ—Reducible, irreducible, and strangulated—Reducible hernia—Taxis—Treatment—"Reduction en bloc"—Operations—Case. Irreducible hernia—Symptoms—Obstruction of a hernia—Treatment—Operation. Conversion of irreducible into reducible hernia—Case—Mode of treatment of irreducible hernia.

The protrusion of any viscus from its natural cavity is termed a hernia; the human body is divided into three cavities,—the cranium, chest, and abdomen—each of which contains its peculiar viscera; a hernia may therefore occur in connexion with either of them, from the escape of any portion of the organs they contain. Owing to the solidity and continuity of the parietes of the cranium, protrusion can, however, only occur in consequence of their malformation or fracture; the parietes of the chest also consist in great part of bone, and the viscera contained within this cavity are firmly fixed by their investing membranes, so that they are but little liable to protrusion: nevertheless, hernial protrusions of the viscera of the chest occasionally happen, and M. Morell-Lavallée has written an excellent monograph upon this subject. He divides hernia of the lungs into four classes, viz. congenital, traumatic, consecutive, and spontaneous. Of congenital hernia of the lungs, only one case is recorded, and in that, the hernia was not discovered until after death; it was found by Cruveilhier in the body of an infant who was the subject of spina bifida. *Traumatic hernia* is occasionally met with, and may be produced by a sword-thrust, or some similar cause; *consecutive hernia* follows rupture of a portion of the parietes of the thorax; and *spontaneous hernia* is that in which the protrusion occurs through any natural outlet from the thorax, but is most frequently met with in the intercostal spaces, where it may, indeed, always be produced in cases of abnormal weakness of the parietes, whether the weakness be congenital or the consequence of disease. M. Morell-Lavallée also states that hernia of the lungs may occur in subjects in whom local debility arises from some cause. The following case is quoted in illustration:—"An officer of the French army in Spain, was seized, without any apparent cause, with a violent and distressing paroxysmal cough, accompanied by pain in the left hypochondriac region. In the course of a few days a tumour, as large as an egg, appeared at the left side of the chest; the size of the tumour increased during inspiration, diminished during expiration, and it completely disappeared under pressure. Rest, regimen, and the application of a compress, so far overcame the affection as to enable him to return to his duties; but he was not free from uneasiness in the side, and was obliged to support the part whenever he took much exercise. The cough returned again in a year after the first attack, and the tumour appeared this time on the right side of the thorax. These tumours required, during coughing, a considerable pressure; and after their reduction apertures could be felt, which seemed to be formed by the rupture of the intercostal muscles." A hernia of the lungs is generally formed in the anterior part of the chest, and is sometimes of very considerable size: if it be slowly formed it obtains a covering from the pleura; and even should the protrusion take place suddenly, it often afterwards becomes enveloped in an adventitious serous membrane. The protruded part is sometimes highly congested, so much so, indeed, as to give rise to the suspicion that it has become gangrenous; which would sometimes induce the surgeon to remove it instead of returning it into its proper cavity. The consecutive hernia usually appears gradually, and without pain; but the spontaneous may form suddenly and with more pain at first; and as these forms of hernia progress, they may either of them give rise to very serious suffering. Spontaneous hernia is sometimes very small at first, but its size increases, particularly during a fit of coughing. A modification of this hernia sometimes exists, which is termed intermittent, as little of the tumour is perceptible, excepting during forcible expiration.

The diagnosis in *thoracic hernia* is sometimes rather difficult, as tumours in the same region, arising from other causes, may readily be mistaken for it. A patient under the care of Dr. Hughes in

Guy's Hospital, the subject of a pulmonary affection, had a swelling on the right side of his neck, which became distended upon coughing; it was supposed by some of the medical attendants of the institution to be a hernia of the apex of the lung, although the usual crepitation of an emphysematous tumour was but very indistinct, if at all appreciable. Dr. Hughes considered it a dilated vein; another thought it chronic abscess; I was of opinion that it was a sero-cyst or hydrocele of the neck. The patient died of phthisis; and an opportunity was thus obtained for post-mortem examination: it was found that there was a dilated internal jugular vein, in consequence of an obstruction to the return of its blood, resulting from adhesions of the pleura, which interfered with the passage of the reflux blood into the vena innominata. There was also found a cyst of considerable size connected with the thyroid gland. A non-reducible tumour could not, however, be easily mistaken for the hernia, unless it were placed in a situation in which it would sink during inspiration, as in the supra-clavicular space; in which case an error might arise. A case has been described in which an abscess appeared between the false ribs and the xiphoid cartilage, and was believed to be a hernia: but the fluctuation and dulness on percussion would be generally sufficient to distinguish such a case.

The prognosis in this description of hernia does not appear to be very unfavourable, judging by the result in the comparatively few cases which are known.

The treatment of consecutive and spontaneous hernia is very simple: after the tumour has been reduced, a bandage, with a compress, is placed firmly over it; and in this way Velpeau has effected a permanent cure in six days.

Notwithstanding that the viscera of the chest are liable to the different forms of hernia I have described, it is to the protrusions of the abdominal viscera that surgical attention is much more frequently directed; they therefore demand our more particular attention.

Abdominal herniæ are very frequent, in consequence of the number of natural outlets or perforations which exist in this region for the transmission of bloodvessels and nerves. The species to which a hernia belongs is determined by the particular region in which the viscus makes its escape. Moreover, there are many peculiarities attendant upon this condition which render necessary the subdivision of each species into varieties: the following table, which I have taken from my friend Mr. Teale's excellent treatise on hernia, exhibits, at one view, a very convenient and correct classification of the subject:—

Genus.	Subgenera.	Species.	Varieties.
Hernia	Cranial		
	Thoracic		
	Abdominal	Inguinal	Oblique Inguinal Hernia Hernia of the Tunica Vaginalis Direct Inguinal Hernia
		Femoral	
		Umbilical	
		Ventral	
		Obturator	
		Ischiatic	
		Perineal	
		Pudendal	
		Vaginal	
		Diaphragmatic	

I have already stated that the internal portion of the walls of the abdomen is formed of the internal abdominal fascia, which prolongs itself with every structure which issues either normally or abnormally, from the cavity; and that the tendons of the abdominal muscles are furnished, at certain points, with apertures to permit of the passage of bloodvessels, nerves, absorbents, and excretory ducts essential to the organization and functions of distant parts. These apertures tend to diminish the power of resistance which the walls of the abdomen elsewhere offer to the escape of the internal viscera.

Besides the internal fascia, there exists a superficial or external abdominal fascia, composed of a somewhat elastic tissue; this structure adds to the strength of the walls in which the natural outlets are situated, and tends to preclude the liability to frequent hernia. After all, however, this affection is one of common occurrence, so much so, indeed, that statistical accounts show that every tenth person is subject to it under one or other of its varieties.

Internally to the two fascia, the abdomen is lined by the splanchnic membrane, termed the peritoneum; by which the viscera are also covered: it may be said, therefore, that every hernia is furnished with three coverings: and although there are two or three exceptions with respect to the peritoneal covering, these exceptions do not invalidate the general fact. These three coverings may be termed the intrinsic coverings of the hernia; while others which differ according to the locality in which the protrusion occurs, may correctly be styled its extrinsic coverings.

A protruded viscus can therefore scarcely be described as being out of the abdomen, but that cavity itself has been extended beyond its natural limits; a condition precisely similar to that of the testicle in its normal state, which brings with it, in its descent from the abdomen into the scrotum, an investment of peritoneum, covered by internal and external abdominal fascia.

The various species of hernia derive their names from the natural outlets by which they issue from the abdomen. I shall mention them in the order in which they most frequently occur.

Inguinal hernia takes its name from the region of the abdomen in which the protrusion takes place, viz. through the opening of the internal abdominal fascia into the inguinal canal; through the same space, indeed, by which the testicle had previously descended from the lumbar region of the abdomen into the scrotum. Inguinal hernia is liable to many varieties.

Femoral hernia.—A protrusion is termed a femoral hernia when the intestine has escaped from the abdomen into the prolongation of the internal abdominal fascia which covers the femoral vessels, and constitutes what is termed their sheath. The protruded intestine does not, however, pass down either with the artery or vein, but quite on the inner side in that division of the sheath which incloses the absorbent vessels.

Umbilical hernia.—This is a protrusion at the navel, where the outlet is differently constituted from any of those already mentioned: for although soon after the division of the umbilical cord, the opening is closed by cicatrization, it always remains a weak point, from which protrusion is liable to occur from want of physical power to resist the pressure from within.

Ventral hernia.—This term has been applied to protrusions of the intestine from any part of the abdomen where bloodvessels pass through the tendinous parietes, particularly in the course of the linea alba and linea semilunares; but not through the muscular parietes, as, in consequence of the arrangement of the fibres of the three large flat muscles, an effective barrier is presented to protrusion through them, unless from some abnormal cause their vital contractile power becomes diminished.

Obturator hernia.—In this hernia the intestine passes through the opening in the ligament of the obturator foramen through which the obturator vessels and nerves are transmitted: this hernia also derives a covering from the internal abdominal fascia.

Ischiatic hernia.—This is a protrusion of a viscus through the ischiatic notch, following the course of the great sciatic nerve;

but from the depth of its situation it can scarcely be discovered during life.

Perineal hernia is produced by the escape of intestine through the lower aperture of the pelvis; it occupies the space between the rectum and urinary bladder, and sometimes forms an external tumour in the perineum.

Vaginal and pudendal herniæ must be considered as modifications of perineal hernia. They take their specific name according as they encroach most upon the vagina or pudendum.

Diaphragmatic herniæ are usually the result either of malformation or laceration of this great septum; in either of these cases the protrusion is not furnished with a peritoneal sac: this hernia is sometimes produced, however, by the yielding of the natural openings through the diaphragm, and it is then supplied with a distinct covering of peritoneum.

Contents of herniæ.—Any of the viscera contained in the abdomen may become the subject of hernia, and the symptoms vary according to the function of the displaced viscus: hence, in forming the diagnosis, it is of great importance to ascertain what peculiar function has undergone disturbance.

In consequence of the looseness of the attachment of the jejunum and ilium to the spine by means of the mesentery, those viscera are particularly liable to escape from their natural cavity.

Herniæ in the region of the epigastrium usually contain the transverse arch of the colon; and as this viscus is intimately connected with the stomach by the omentum, so much derangement in the functions of the stomach is generally produced, as to have led in some cases to the belief that that organ was itself protruded. This is, however, very rare, and the stomach seems to be liable to displacement only in case of malformation of the diaphragm. I have myself witnessed a case of this diaphragmatic hernia, in a child who had died of remittent fever, with some anomalous symptoms that were afterwards accounted for in great measure by the abnormal position of the stomach. Many years since, I saw a very large scrotal hernia in a patient of Mr. Dalrymple, of Norwich; strangulation had occurred, and it was necessary to resort to the operation: the patient died, however, and on post-mortem examination it was found that the whole length of the intestinal canal was contained within the hernial sac, and even the pyloric extremity of the stomach was drawn down as far as the external abdominal ring, the stomach forming a continuous tube extending from the hypochondriac region across the abdomen to the right side of the pubic region.

The ovaria, Fallopian tubes, and even the uterus, sometimes constitute the contents of a hernia, giving rise to symptoms which rather indicate disturbance in the functions of the procreative organs, than in those of the alimentary canal. Mr. Teale mentions a case of a young female, from whom the ovaria were removed by Mr. Nourse, of St. Bartholomew's Hospital, in consequence of their protrusion into the inguinal canal, producing so much inconvenience as to incapacitate the girl for her ordinary avocations. After the operation, she completely recovered her health, but ceased to menstruate, although that function of the uterus had previously been properly performed.

The cæcum is occasionally the subject of hernia, which is peculiar on account of the absence of a peritoneal sac.

There are no very distinct and well-marked symptoms to enable the surgeon to ascertain with accuracy the exact portion of intestine which really forms a hernia; for as a hernia of intestine must necessarily interfere with the general functions of the bowels, the symptoms arising from such obstruction are very similar, whatever may be the portion of intestine protruded.

About a year ago, I performed the operation for inguinal hernia on the right side, on a patient of Mr. Ward, of Watford. On laying open the internal abdominal fascia (usually termed in this situation the fascia spermatica interna), I immediately exposed the intestine, uncovered by peritoneum; from its broad muscular bands, and the presence of the vermiform process, it was seen to be cæcum. As soon as I divided the stricture, the patient evacuated the bowels per anum; I considered this a very favourable symptom, but he died of peritonitis the fifth day after the operation.

It may be supposed that hernia of the cæcum could only occur on the right side; but cases are recorded in which it has passed over so as to constitute a hernial protrusion on the left side of the body. This I should, however, imagine could only happen secondarily, the viscus being drawn over by an extraordinary protrusion of the ileum to which it is attached; indeed, on the right side, the cæcum may protrude into a hernial sac already formed by the ileum, and nothing but the great size of the tumour could lead to the supposition that such a condition existed.

In the left inguinal region, the sigmoid flexion of the colon sometimes fills the hernial sac: it may be uncovered by peritoneum, and be altogether under circumstances similar to those which relate to the cæcum. The diagnosis is less difficult in these cases, if none of the small intestines be affected; for the symptoms indicate obstruction of the large intestines alone, and are unmarked by urgent or stercoraceous vomiting.

Hernia of the urinary bladder sometimes takes place, the circumstances, as far as refers to its coverings, being the same as in hernia of the cæcum, the bladder being only partially covered by peritoneum. The symptoms are, however, sufficiently distinctive, and clearly indicate the particular organ protruded. The principal predisposing cause of this hernia is, abnormal distention of the bladder by protracted retention of urine: it remains, when emptied, in a flaccid condition, and exceedingly liable to be protruded through the abdominal rings, if they happen to be at all enlarged. Many cases of such herniæ are recorded, and even some in which the bladder contained urinary calculi, that were safely removed by laying open the hernial tumour. Some years ago, I saw a gentleman at the house of my friend, Mr. Cooper, of Brentford, who was the subject of hernia of the bladder. The viscus seemed to have escaped as a direct inguinal hernia, through the external abdominal ring, proceeding downwards, partly into the scrotum, and partly into the inguinal canal. This gentleman could only empty the bladder completely by raising the scrotum, and pressing at the same time both the scrotal and inguinal tumour. In this case, Mr. Bigg contrived a suspensory bandage, capable of exerting pressure upon the inguinal region: this afforded very considerable relief to the inconvenience and annoyance of such a condition.

Sir Astley Cooper has described the dissection of a case of hernia, in which the urinary bladder formed part of the contents of a hernial sac, intestine and omentum being protruded at the same time; the bladder was, however, situated behind the sac, being merely adherent to, and not within it.

An important symptom of hernia of the bladder is, the frequent desire to make water, from the patient not being able to perfectly empty the organ. It may be supposed, that ventral herniæ of the bladder would not be very unfrequent, as we so often find congenital malformation of the anterior parietes of the abdomen in the pubic region. When, however, such a hernia does occur, it is not of the usual character of ventral hernia, but it is found that the anterior surface of the bladder is equally defective with the parietes of the abdomen, so that the protrusion presents the mucous surface of the posterior wall of the organ, without any peritoneal covering. I have seen several cases of this kind, and know a gentleman, now living, and upwards of forty years of age, who is the subject of this malformation, and suffers, indeed, little more than the inconvenience arising from the constant exudation of the urine.

Herniæ not only derive their distinctive names from the openings through which they protrude, but also from the name of the viscus they contain. If, for instance, the tumour contains intestine alone, it is termed an enterocele; if omentum, an epiplocele; if both intestine and omentum, an entero-epiplocele; and, in like manner, if the tumour be formed by the protrusion of the urinary bladder or uterus, it is termed respectively a cystocele or metrocele.

Causes of Hernia.—The cause of a hernia may be either predisposing or exciting. The weakness of the parietes of the abdomen, owing to the number of outlets they contain, may perhaps be looked upon as the most fruitful source of the protrusion of abdominal viscera; and any influence which tends to increase the size of these openings, must increase the liability to hernia. Each opening appears to be furnished at its external circumference with an arrangement of muscular fibre, which, when in action, resists the escape of the inclosed viscera. Diminution of the muscular irritability will, therefore, diminish the natural resistance at these points. This is proved by the circumstance, that hernia is seldom produced by violent voluntary muscular exertion; but, on the other hand, occurs very often under sudden exertion, when the muscles of the abdomen are unprepared to maintain the equilibrium of resistance, as in making a strong sudden effort to recover a false step, or in the shock communicated to the body by the stumbling of a horse. The debilitating influence of long illness upon the muscular system also strongly predisposes to hernia; and persons who are suddenly reduced from obesity to comparative thinness are very liable to it, from the relaxed condition in which the walls of the abdomen are left, and from the absorption of the fat which frequently serves to partially fill up the openings. A similar condition is very often the result of the evacuation of the fluid in ascites. Congenital defects may also constitute a prominent predisposing cause of hernia; and this, as well as the other causes already enumerated, tends to the liability to protrusion of the viscera, on the accession of any exciting cause, whatever it may be.

One of the most frequent of the exciting causes of hernia is cough of long standing; which, from the contractions it produces in the diaphragm, gives rise to a continued pressure of the viscera downwards, tending to force the more moveable intestines through the enlarged apertures which traverse the already weakened walls of the abdomen. Constipation of the bowels, and permanent stricture of the urethra, in both of which continued muscular exertion is required in the expulsion of the excretions, often give rise to hernia; and mechanics, from wearing belts, and females, from the pressure of ill-shaped and excessively tightened stays, are rendered extremely liable to visceral protrusions; which are also sometimes produced by blows on the abdomen; but, in that case, the hernia is generally accompanied by laceration, either of the muscles or their aponeuroses.

As the hernia necessarily passes through a constricted opening, the point at which it protrudes must be the narrowest portion of the swelling, and is technically termed the neck of the hernia: this constitutes the most important part of the tumour, as it is here that the chief difficulty is experienced in returning it into the abdomen. This difficulty is sometimes, indeed, insuperable: under those circumstances, a surgical operation becomes necessary. The central portion of the hernial tumour is termed the body, and its free extremity the fundus. This division may appear unimportant, but by directing your attention to the general configuration of the swelling, and the continuity of its neck with the interior of the abdomen, the diagnostic marks between hernia and other tumours resembling it, are rendered much clearer than they would otherwise be; and this arrangement will also be found convenient in referring to the tumour, when describing the manner and direction in which the force is to be applied in its reduction.

Conditions of herniæ.—A hernial tumour must always be in one of the four following conditions; viz., *reducible, irreducible, obstructed*, or *strangulated.* A reducible hernia is that which by the application of a slight force may be returned into the cavity of the abdomen. The force employed in effecting this, is technically termed *taxis.* I shall not, however, describe this at present, as the direction in which the force is to be applied differs in every kind of protrusion, and must be modified according to the particular direction taken by the viscus. As a general rule, it may, however, be stated, that the taxis should be applied while the patient is in the recumbent position, with the trunk and extremities elevated, to relax the abdominal muscles.

Treatment of reducible hernia.—You will often find, gentlemen, when called to a case of hernia, that the patient, instead of at once informing you of the existence of a tumour in the abdomen or some other region, will probably complain of a sensation of tightness in the scrobiculus cordis—a general tenderness over the abdomen, and a constipated state of the bowels, attended by more or less nausea. These symptoms would at once lead to inquiry and examination to ascertain whether a tumour existed in any part of the abdomen; this is more particularly necessary with females, whose natural delicacy would perhaps render them unwilling to mention the circumstance.

If it be ascertained that a tumour does exist, and that it be tender and its surface tense, the taxis should not be immediately applied, but the patient should be placed in a hot bath (100°), and kept under its influence until a slight degree of faintness be produced, if he be of a full plethoric habit. This condition may be maintained by abstracting a small quantity of blood from the arm: and, where there is reason to suppose that the large intestines are loaded, an enema should be administered.

As soon as the patient is put to bed the attempt to reduce the hernia may be made, and, if this be successful, a truss must be immediately applied, to prevent reprotrusion. Should the hernia not be returnable by the taxis, it becomes a question whether the operation ought to be performed immediately, or whether the return of the intestine should be further attempted by other means. This depends upon the urgency of the symptoms, and the length of time during which the hernia has remained protruded. If the sickness be not violent, and the tenderness not very great, a bladder of ice may be applied to the tumour; this checks the flow of blood to the part and causes it to contract; the taxis must then again be applied, and the hernia may perhaps now be returned into the cavity whence it had escaped. Supposing the attempt to be successful, purgative medicines should not be immediately prescribed, but the patient allowed to remain in a state of quietude, to give time for the intestine to recover from the abnormal condition in which it had been placed; and, even should the patient remain several days without evacuating the bowels, unless there were sickness, I should not consider it judicious to interfere with the operations of nature by medical treatment. As soon as the patient has had a motion naturally, he may generally be considered convalescent. It must not, however, be taken for granted that the restoration of the protruded viscus to its natural situation will invariably relieve the symptoms; it sometimes happens that the hernial sac itself is returned with its contents. This is termed by the French "reduction en bloc." The symptoms may in that case all continue; for, in fact, the only change produced is, the conversion of an external into an internal hernia. The treatment under these circumstances will form the subject of future consideration.

It may be inferred, from what I have already said, that the reduction of a hernia is invariably to be attempted. This is not, however, the case; for if the swelling be of long standing,—if the urgent symptoms should have subsided,—if the tumour has become suddenly distended, and the skin discoloured,—it indicates that the contents of the sac have become so much changed as to be incapable of restoration: they are therefore unfitted to be replaced within the abdomen. In this case the hernial sac should be laid open, the stricture divided, and the real condition of the intestine ascertained by ocular examination; the surgeon is then enabled to decide whether it be still in a fit state to be replaced: if it be found sphacelated, a free incision should be made into it, to produce an artificial anus. Many instances are on record in which the patient has perfectly recovered under this mode of treatment.

When the attempted reduction of a hernia has proved successful, a truss must be immediately applied, for the purpose of retaining the returned parts within their natural cavity. I always order a double truss to be worn, even where the rupture is on one side only; for the equable and symmetrical pressure is more agreeable to the patient, and likewise prevents the tendency to rupture on the opposite side, often induced by wearing a single truss. Bandages and compresses are sometimes found sufficient to retain the hernia without the use of metallic springs; but the former are generally employed only in umbilical and ventral herniæ. All mechanical contrivances may, indeed, be found ineffectual in preventing the reprotrusion: hence various operations have been devised for producing "the radical cure" of reducible hernia. The object, under these circumstances, is the permanent closing of the aperture through which the intestine passes. Most of the proposed operations are, however, in my opinion, unwarrantable, from the great danger of producing peritonitis: indeed, I consider all operations on the hernial sac, such as excision, cautery, ligature, and so forth, as extremely reprehensible.

An operation has, however, been recommended by M. Gerdy, and I have once performed it on a patient who had a large scrotal hernia, the descent of which could not be prevented by any kind of truss. I was therefore induced to try this operation, because, of all those proposed, it seemed to me least likely to cause inflammation of the peritoneum. The following is an account of the case:—

John Hollman, æt. 22, was admitted into Guy's Hospital, 1840, with a large reducible inguinal hernia on the right side; and, as this could not be retained in the abdomen by a truss, he was rendered perfectly unable to follow his usual avocations, and consented readily to the operation which I proposed. Being placed on his back on a table, with his chest and thighs raised, I passed the forefinger of my left hand as high up as I could through the external ring into the inguinal canal, pushing before it a portion of the integument of the scrotum. I then introduced a director, along which I passed a needle fixed in a wooden handle, and armed with a double silk ligature. The needle was passed to the very extremity of the invaginated skin, and was pushed through the tendon of the abdominal oblique muscle and skin, and brought out an inch and a half above Poupart's ligament. One end of the silk was then held by an assistant, and the needle drawn back, and pushed through a second time in exactly the same manner as at first, but including about four lines of the invaginated integument. The two free ends were then tied over a piece of bougie, with a sufficient degree of tension to retain the intruded portion of integument firmly within the inguinal canal. A piece of lint wrapped around a director, and dipped into liq. ammon., was passed into the "cul-de-sac" of skin, and the surface well rubbed with it, to remove the cuticle and promote inflammation in the cutis, for the purpose of obliterating this integumentary canal, and forming a plug sufficiently firm to prevent the future descent of the hernia. The application of the ammonia produced intense pain; this was, however, relieved by opium. Four days after the operation the ligature was removed, as purulent discharge was freely established. Pressure was kept upon the part by compresses, to promote perfect union, and in about three weeks a weak truss was applied; but he still remained in the hospital another fortnight, after which, as the hernia did not descend, he left. About two months after he had returned to his employment, which was of a violent character, the hernia partially descended; but, by the use of a stronger truss, he has ever since been able to continue at work, being, however, sometimes subject to a slight return of the affection: this man may be said to be relieved, but not permanently cured, by the operation.

Irreducible hernia.—This is a form of hernia in which, although the contents cannot be returned into the abdomen, they are not subjected to sufficient constriction nor obstruction to render them incapable of performing their natural functions. It is sometimes termed incarcerated hernia. The distinction between the two is, however, perfectly obvious: in one case, the contents of the sac are only permanently retained in it; in the other, the intestine is so much restricted that its natural functions are completely impeded. It rarely happens that a recent hernia becomes at once irreducible, unless it be immediately strangulated; and by far the most frequent cause of a hernia becoming irreducible, is the employment of an ill-fitting truss; which, admitting of the descent of a reducible hernia, presses upon the contents of the sac, and produces thickening of the parietes, and, perhaps, at the same time, adhesion between the intestine and the interior of the sac. Any circumstance, however, which leads to inflammation of the contents of a reducible hernia, may induce its incarceration. No very violent symptoms necessarily present themselves to mark the conversion of a reducible into an irreducible hernia: the functions of the alimentary canal may still be duly performed, and the patient may seem to be perfectly free from danger; but any internal functional derangement or slight external injury would, perhaps, suddenly produce the most urgent symptoms: for example, undigested matter of any kind passing into an incarcerated knuckle of intestine, is retained, not only in consequence of the form of the protruded bowel, but also from the diminution of its peristaltic action; and thus an irreducible is converted into an obstructed hernia.

The symptoms arising from such an obstruction, are very similar to those in strangulated hernia, but are less urgent in their character; and the history of the case, and the gradual progress of the symptoms, enable the surgeon to judge between them.

When it is decided that the case is one of obstruction, and not of strangulation, copious enemata of gruel and castor oil should be administered, and purgatives employed at the same time. These means are usually found sufficient; but the warm bath, and the application of ice to the tumour, may in some instances be required. If, however, the hernia should be obstructed in consequence of external injury, purgatives ought not to be prescribed; but leeches, and afterwards ice, applied, and the patient kept in perfect rest, as any attempt to produce evacuation may lead to lesion of the injured intestine; while, if nature be left uninterfered with, evacuation will take place as soon as the bowel is sufficiently restored to render it capable of supporting the necessary action.

If the obstruction, whatever be its cause, cannot be overcome by the means indicated, there remains no alternative for the surgeon but to perform an operation similar to that in strangulated hernia. But if the obstruction be removed, and the hernia still remain irreducible, it is of great importance to convert it, if possible, into the reducible form, without having recourse to a surgical operation. The mode of effecting this is well illustrated in the following case:—

A young farmer, who was the subject of irreducible hernia, was sent to me by Dr. Baddeley of Chelmsford. The hernia was of two years' standing, and so anxious was the patient to obtain relief, that he was willing to submit to any system of treatment that promised to afford it. I prescribed, in the first instance, purgatives, to produce complete evacuation of the bowels, and ordered him to remain in bed, with his shoulders and thighs raised, so as to perfectly relax the abdominal muscles. A low diet was strictly enjoined, and a grain of blue pill and a quarter of a grain of tartarized antimony given twice a day, with the intention of stimulating the absorbents to the removal of the fatty matter of the omentum. Ice was frequently applied, and also enemata to keep the intestines empty. So anxious was the patient for the removal of his complaint, that he submitted to these restrictions during the space of five weeks, but in that time, beyond a slight diminution in the size of the tumour, no favourable change had been produced. At last, quite despondent at this want of success, in a fit of impatience he one morning jumped out of bed, when, to his great surprise and joy, the tumour suddenly disappeared. He immediately applied his truss, and has never experienced the least return of the protrusion; taking care, however, always to wear a truss even in bed.

From the successful result of the treatment in this case, I have been frequently induced to repeat it, both in hospital and private practice, and have found it very successful. If, however, the efforts of the surgeon should prove abortive, and the hernia remain irreducible, an apparatus should be contrived to support the tumour and defend it from external injury; and, at the same time, the most scrupulous attention must be paid by the patient as to his diet, both in quality and quantity; for, by any slight inattention to the rules laid down, he renders himself liable to a return of the disorder, and consequent imminent danger to his life.

LECTURE XXXIX.

Strangulated hernia—Its characteristics—Stercoraceous vomiting—Progress of symptoms—Changes in physical characters of the tumour indicating gangrene—Distinctive marks between strangulation of intestine and omentum—Between strangulated and obstructed hernia — General treatment of strangulated hernia—Taxis—Question as to immediate operation—use of opium—Cases—Inguinal herniæ—Oblique inguinal herniæ—Varieties.

Strangulated bubonocele—Diagnosis—Cases—Taxis—Operation—Comparative danger of the operations — Cases — Congenital bubonocele—Cases—On the division of the stricture—Case—On returning intestine after the division of the stricture—Cases—Adhesions to the sac or omentum.

Oscheocele—Coverings—Strangulated scrotal hernia—Taxis—Operation—Congenital scrotal hernia—Situation of testicle—Case.

Strangulated hernia.—A hernia is said to be strangulated when its contents are so much constricted at the outlet through the abdominal fascia as to put a stop to the natural function of the bowel.

In strangulated hernia the symptoms often follow immediately upon the protrusion, and are severe in proportion to the degree of constriction. Usually the first symptom is tightness around the scrobiculus cordis; sometimes so acute as to render the patient incapable of maintaining the erect posture. Vomiting soon comes on, and is more or less severe, according to the proximity of the strangulated portion to the duodenum. Insuperable constipation also forms a prominent feature in strangulated hernia, and there is generally great anxiety of countenance, restlessness, small, quick, and hard pulse, and a general sensation of coldness over the whole surface of the body. If these symptoms continue for any length of time, the vomited matter acquires a fæcal or stercoraceous odour: a circumstance which has led some surgeons to suppose that the contents of the large intestines are regurgitated. This I think is scarcely possible, and I believe the fæcal odour to proceed from the retention of the contents of the small intestine, and not from feculent matter passing back through the ilio-colic valve. If the strangulation be not overcome, hiccup very soon supervenes, the surface of the body becomes covered with a cold sweat, the pulse is scarcely to be felt, respiration is weak and irregular, and the pain becomes gradually less severe. The physical characters of the tumour now begin to change, the skin becomes discoloured, and, on pressing the tumour, a fluctuation is felt, instead of the tension which previously characterized it: these are indications that the bowel has given way from mortification. If such urgent symptoms were to succeed each other rapidly, it would lead to the supposition of *intestine* being strangulated; for where *omentum* alone is protruded and strangulated, although the above symptoms may occur, they are always in a milder form, and very frequently alvine evacuations may be produced by purgative remedies, while all the other symptoms remain; but even when evacuation takes place we must not be too hasty in forming a favourable prognosis,—for, although this one symptom is relieved, the others may remain insidiously operating on the constitutional powers of the patient to the ultimate destruction of his life. It does not necessarily happen that the acute form of strangulated hernia should be the immediate result of protrusion; for my late colleague, Mr. Wilkinson King, has shown from a statistical account of 98 cases of strangulated hernia requiring operation, that 94 of them became strangulated at various distant periods after the protrusion. He attributes this liability to strangulation to "a certain decline of vigour and health, connected with the manifest deterioration of the depurative organs of the body, rendering the protruded part more liable to tumefaction, so that it becomes strangulated, owing to its ready turgescence." I am inclined to believe, however, that most of these cases should have been considered as the result of obstruction, and not of actual strangulation; the first being an influence exercised from within to without, the second from without to within. In the former case, gentle purgatives and enemata are frequently found sufficient to overcome the obstruction, while in the latter the constriction must be removed, to permit of the tumour being returned into the abdomen.

Treatment of strangulated hernia.—The first object in strangulated hernia is to effect its reduction, if possible, by means of the taxis, and where the symptoms are not very acute, this may be attempted without any preliminary preparation of the patient; but, if the tumour be very painful, and general febrile symptoms be present, recourse must be had to bleeding, warm-bath, and the application of ice to the tumour, as I have already described. Should these means fail in rendering the hernia reducible, the division of the stricture is the only alternative; at the same time, no question in surgery is more difficult than to decide upon the proper moment at which the operation should be performed.

When, from the suddenness and severity of the symptoms, and the tension of the tumour, a very tight stricture is indicated, there can be no doubt that the operation should be performed as soon as possible; for the rapid changes which take place in an intestine subjected to such constriction, very soon unfit it for the performance of its natural duties, even if it could be restored to the abdomen: the severity of the symptoms may indeed be so great, that the operation ought to be performed without even attempting to return the intestine by the application of the taxis. When symptoms of strangulation come on progressively, as in an old hernia, some delay may be permitted, even beyond that required for the application of the remedies already recommended, as even when those prove ineffectual I have frequently succeeded by giving large doses of opium,—in some cases as much as three or four grains. Constipation being one of the most urgent symptoms of hernia, and opium having a tendency to produce that condition of the bowels, it may naturally be asked what is the rationale of the treatment. I believe that the opium allays irritation, and checks sickness, by diminishing the antiperistaltic motion of the intestines; and thus it produces a condition of quietude through the whole intestinal canal, adapted to improve the state of the protruded parts. I have never recommended opium by choice as a substitute for the operation; but in four or five cases in which the patient would not submit to it, I have employed opium with perfect success. I first learned this practice from the late Mr. Bush, of Frome, in Somersetshire, who informed me, that although at one time of his life he had had to perform the operation for hernia several times in the course of every year, after he had adopted the use of opium he had rarely had occasion to resort to it.

In July, 1838, I admitted a man 64 years of age, into Guy's Hospital; he was the subject of strangulated inguinal hernia of five days' standing: he suffered from constant vomiting, insuperable constipation, and, indeed, all the symptoms of strangulation. I attempted to reduce the hernia but could not succeed, and therefore proposed an immediate operation. To this the patient would not, however, submit; so I ordered him three grains of solid opium; in about four hours the sickness was much relieved, and some flatus passed per anum, but the constipation still remained. At twelve o'clock the same night, my dresser, Mr. Coleman, repeated the dose of opium. The patient passed a very quiet night, and in the morning the vomiting had ceased, and a copious motion was passed, during which the hernia returned into the abdomen. The patient perfectly recovered.

In June, 1839, a married woman, æt. 54, was admitted into Esther ward, with a femoral hernia on the right side. The tumour was about the size of a small orange, tense, and very tender when touched. The patient was placed in a warm bath, an enema administered, and the taxis applied, but unsuccessfully. I consequently proposed the operation: the patient would not, however, consent to it, and I ordered ice to be applied to the tumour. The next day, all the symptoms remaining unaltered, I again attempted the reduction, still, however, without success; and I now ordered her to take four grains of solid opium. The symptoms were soon relieved; a castor oil enema was administered, and on the second evening after her admission into the hospital the bowels were slightly evacuated, and my dresser, Mr. Day, succeeded in reducing the hernia. This patient also recovered.

In another case I was sent for by Mr. Odling, to see a lady at Islington, who was suffering from all the urgent symptoms of strangulated hernia. The warm bath had been employed, ice applied to the tumour, and several attempts made to reduce it by the taxis. This treatment was not, however, successful, and as the patient would not submit to an operation, four grains of opium were given: the symptoms were soon all relieved, and early the next morning the bowels were evacuated, after which the patient herself reduced the hernia by the application of very little force.

An old gentleman, who lived in Great Windmill Street, and who had long been the subject of irreducible hernia, was suddenly seized with symptoms of obstruction of the bowels, which did not yield to the usual remedies, and as sickness, as well as the other signs of insuperable constipation, came on, Sir Astley Cooper was sent for. He, however, happened to be unwell, and I went in his stead to visit the patient. I ordered enemata, ice to the tumour, and calomel and opium to be taken to allay the vomiting. No relief was, however, obtained, and I consequently proposed the operation. This was objected to, and I was therefore constrained to employ some further medical treatment. Four grains of opium were administered, and five hours afterwards I again saw the patient: the sickness had ceased, but no evacuation had yet taken place. I then recommended a warm gruel injection, with an ounce of castor oil, and in the evening, the alvine excretions passed freely, and the patient shortly recovered.

Mr. Shelly, of Epsom, had a patient, a lady, 40 years of age, under his care, who, during three days, had suffered from urgent symptoms of strangulated hernia; and when first seen by Mr. Shelly, she had stercoraceous vomiting. He attempted to reduce the hernia, but not succeeding, recommended the operation. The patient refused to submit to this, and Mr. Shelly, jun., who had been one of my dressers, and who had seen the effect of opium in one or two cases in Guy's Hospital, immediately gave her two grains of solid opium, and further ordered a grain to be taken every two hours. She took four doses before the sickness and pain ceased, but the next day the bowels were relieved, the hernia was easily reduced, and she perfectly recovered.

Should every means fail, however, in effecting the reduction of a strangulated hernia, the surgical operation must be resorted to; and as every species of hernia requires some peculiarity in the method of proceeding with the operation, it is requisite to describe the steps in each particular kind.

Inguinal hernia.—This term is employed to indicate the protrusion of any abdominal viscus through the internal or external abdominal ring. When the hernia passes through the internal ring, it is termed an *oblique inguinal hernia;* when through the external ring only, a *direct inguinal hernia.* As the oblique is by far the most frequent, I shall commence with a description of it.

An oblique inguinal hernia protrudes through the internal abdominal ring with the spermatic chord in the male, and the round ligament in the female, having the epigastric artery placed on the inner side of its neck; it has been designated by some surgeons an "external inguinal hernia," in reference to its position with regard to the artery. An oblique inguinal hernia is subject to certain varieties, each bearing its appropriate name; for instance, if the hernia protrudes only into the inguinal canal, although it is in fact still an oblique inguinal hernia, it is called a *bubonocele;* if it proceeds downwards, however, so as to pass through the external ring, it takes the name of *oscheocele* or *scrotal hernia:* both these herniæ are usually covered by a distinct peritoneal sac, and pass through the rings in front of the spermatic chord, and external to the tunica vaginalis. Sometimes, however, when the tunica vaginalis is not closed from the great peritoneal cavity, an oblique inguinal hernia passes down into it, without any additional covering of peritoneum; it then constitutes what is termed *congenital hernia.* Each of these varieties, when strangulated, has the point of constriction on the outer side of the epigastric artery, and requires, for the relief of the patient, either the successful application of the taxis, or the division of the stricture by operation.

Strangulated bubonocele.—The diagnostic marks of this species of hernia are the situation of the tumour on the outer side of the pubes, and above Poupart's ligament; it is true that the swelling may be so large as to cover the spinous process of the pubes, and overlap Poupart's ligament, so as to descend upon the thigh, assuming the appearance of femoral hernia; but a bubonocele can generally be distinguished from the latter by the readiness with which it can be pushed upwards, so that it may be placed in its characteristic situation directly on the outer side of the pubes, and above Poupart's ligament. Still, great difficulty sometimes occurs in distinguishing between them. January 20, 1840, I admitted a patient into Esther ward, who was the subject of a large hernial tumour in a state of strangulation, but it was of such an anomalous form that there was some difference of opinion as to whether it was inguinal or femoral, in consequence of its encroachment on the labium pudendi. Having used the usual means preparatory to the employment of the taxis, such as the application of ice and an injection, I attempted to return the hernia, and succeeded in restoring to the cavity of the abdomen all but a very small portion: it was thus rendered quite clear that it was a femoral hernia. It seemed that the protrusion had passed out of the saphenous opening in the fascia lata, and then extended itself between the skin and fascia lata to the pudendum, giving it the appearance of an inguinal hernia.

A servant of Dr. Babington had a strangulated congenital hernia, which passed partly through the external abdominal ring into the scrotum, but by far the larger portion of the tumour remained in the inguinal canal; and, from its size, so overlapped Poupart's ligament, and encroached on the thigh, as to have very much the appearance of a femoral hernia, in addition to the scrotal one. Mr. Morgan, by a long-continued application of the taxis, succeeded in reducing the hernia, and clearly proved that the apparent femoral portion of the swelling had in fact been placed in the inguinal canal, in which an undescended testicle was also felt.

When the particular species of hernia has been ascertained, the first step is to apply the taxis, an operation which requires considerable knowledge of the anatomy of the inguinal canal to enable the surgeon to obtain from it its full advantages. The inguinal canal is placed within the muscular parietes of the abdomen, passing obliquely from the internal ring downwards and inwards to the external; the pressure to reduce the hernia must therefore be exerted upwards and outwards, which direction is, however, only to be followed in cases of oblique inguinal hernia. If it be found impracticable to reduce the hernia by the taxis, the stricture must be removed by surgical operation.

Operation for strangulated bubonocele.—This operation consists in enlarging the opening of the internal abdominal ring through which the hernia has escaped. To effect this, the inguinal canal must be laid open to expose the *intrinsic* coverings of the hernia: an incision is made in the course of the tumour, commencing from within an inch of the internal, and extending to the external, ring, cutting through the skin and superficial facia, so as to expose the tendon of the external abdominal muscle: this tendon is divided to a similar extent, and in the same direction as in the first incision. The hernial tumour enveloped by the internal abdominal fascia and peritoneum will now be exposed, partly overlapped, perhaps, by the free edges of the internal oblique and transversalis muscles; these may be turned upwards off the tumour by means of the finger, and without cutting, so that we may proceed to open the internal abdominal fascia (the fascia spermatica interna). A director is passed into the opening which has thus been made, and being gently pushed upwards enters the cavity of the abdomen; the force required for this being in proportion to the tightness of the stricture. A hernial knife is inserted into the groove of the director, and passed along until it enters the abdomen, having, consequently, been pushed beyond the point of the constriction: the cutting edge of the knife is then turned forwards so as to divide the stricture, the division being made directly upwards; and, indeed, any inward direction is to be especially avoided, owing to the proximity of the epigastric artery. This division of the stricture external to the peritoneal sac usually proves sufficient, and the hernia may be returned by gentle manipulation: if the hernia be thus reduced, the operation is completed, but if there be any adhesions between the contents of the hernia and its peritoneal sac, or any other cause which prevents its return, the peritoneal sac itself must be laid open for the purpose of removing the obstruction.

The operation of dividing the stricture external to the sac may, I think, be looked upon as little more dangerous than the ordinary application of the taxis, for there can be no doubt that the great danger in the usual operation for hernia consists in opening the peritoneal cavity, and I have frequently had patients recover after the external division of the stricture with as much freedom from bad symptoms as when the hernia is returned by the application of the taxis alone. On January 5th, 1844, I operated on a boy for strangulated hernia, the strangulation having existed for two days. I divided the stricture external to the sac, and was able to return the intestine by a very slight exertion of force; not a single bad symptom supervened, and the patient did not appear to suffer more than in reduction by the usual method, without operation. I had also a patient in Cornelius ward, on whom I operated for a strangulated inguinal hernia, on which the late Mr. Key had operated three years before; in this case I divided the stricture without opening the sac, and to my great satisfaction the contents of the sac were easily reduced: the patient did not present any symptom of having been subjected to an operation, and even the collapse almost invariably attendant on the operation for hernia was in this case wholly absent. I could enumerate several cases equally successful.

To Mr. Key is attributable the introduction of this plan of treatment in cases of recent hernia, as formerly surgeons recommended the division of the stricture external to the sac only in cases of very large herniæ, and such as were of long continuance.

Congenital bubonocele.—If the bubonocele be congenital, the operation will be the same as that just described; the stricture exists at the same point, and is produced by the same cause; the only difference is, that the congenital bubonocele passes into the tunica vaginalis, and is without any further peritoneal covering. If, however, circumstances render it necessary, in the operation for a strangulated congenital bubonocele to lay open the tunica vaginalis, the testicle will be seen lying within that covering, and usually below the protruded intestine, so that, even before the opening is made, the diagnosis of the congenital character of the hernia may be formed to a certain extent, from the testicle constituting a second tumour immediately below the true hernial protrusion.

There are certain difficulties which may arise in the operation for a strangulated bubonocele, as well as in its diagnosis; in making the first incision, for instance, branches of the external epigastric or circumflex iliac arteries may give rise to a hæmorrhage that will render it necessary to apply a ligature to those vessels, for even should the bleeding not be sufficient to produce danger from loss of blood, it would obstruct the operation, and should therefore be immediately arrested. On dividing the tendon of the external abdominal oblique muscle, instead of exposing the hernial sac, we may discover a varicose condition of the spermatic veins, a hydrocele of the chord, an undescended testicle, or a cyst, perhaps, connected with the ovarium; or a steatomatous tumour may conceal the hernia from view. It is, therefore, necessary in all cases to be prepared for such contingencies, and even when they are met with, if the symptoms of hernia are present, whatever the concomitants may be, the malady must not be referred to them, but careful examination further made, to ascertain, beyond all question, the presence or absence of a visceral protrusion. In a former lecture I mentioned the case of a surgeon, who, in seeking for hernia, found hydrocele of the chord; without further investigation, he set this down as the origin of the symptoms, and allowed the hernia, which, in fact, existed, to remain constricted until the life of the patient was sacrificed. I therefore again urge the necessity for pushing inquiry in such cases to the most extreme limit. I have myself met with considerable difficulty whilst operating in a case of congenital bubonocele, from mistaking a nondescended testicle for a hernial sac: very lately, my colleague, Mr. Cock, in operating in a case of bubonocele, found a second tumour beside the protruded intestine, and upon dividing the stricture a quantity of viscid fluid escaped. He was consequently led to consider it as an encysted tumour, proceeding probably from the ovarium. The unexpected occurrence did not, however, prevent the completion of the operation; as the hernia was reduced, and the patient recovered. Psoas abscess sometimes makes its way into the inguinal canal, and when concomitant with bubonocele, pus might escape during the operation. A case occurred some time ago at Epsom, in which, with all the symptoms of hernia, a tumour was discovered in the abdomen; the tumour was, however, distinctly fluctuating; it was therefore punctured, and pus let out: the evacuation of the matter satisfied the surgeon; he set down all the symptoms to the account of the abscess, and did not seek for anything further. As the opening of the abscess did not, however, relieve the patient (the symptoms of hernia remaining), in a short time he died, and upon post-mortem examination a hernia was found, in addition to the abscess from which the matter had been discharged. Some difficulty may also arise in the division of the stricture, according to whether it be attempted externally to, or within, the sac. In the first case there may be a difficulty in recognising with certainty the fascia spermatica interna. It may be supposed that this tissue is exposed before it is in fact reached, and until it is opened the stricture cannot be divided; the best criterion for knowing when this fascia is laid bare, is the appearance of the fibres of the cremaster muscle, the complete division of which must expose the fascia.

A hindrance to the division of the stricture may also occur from the tightness of the constriction round the neck of the sac. This difficulty renders it necessary to employ the greatest caution, both in passing the director through the stricture, and also in passing the hernial knife. Many cases are on record in which the intestine has been wounded in this step of the operation; and I believe there are few operating surgeons who have not met with this accident. About two years ago I was sent for to operate on a lady who was labouring under strangulated hernia. She was one in whom I felt a more than usual interest, from the earliest associations of my youth. I mention this only to show that it was a case which commanded my utmost care. After I had divided the stricture (which was very tight) with my own "guarded" hernial knife, a quantity of fluid escaped, and a violent burning pain, attended with a sensation of extreme tension throughout the abdomen, was immediately experienced by the patient. About four hours after the operation she expired; and, in a post-mortem examination, an opening was found in the intestine, and, from its appearance, I have no doubt of its having been inflicted by the knife during the operation.

The effusion from the bowel (which proved fatal in this case) may, however, take place without the intestine having been wounded by the knife, as lesion of the protruded part may sometimes be produced by the constriction to which it is subjected; but I think the appearance of the opening in the bowel would always indicate the nature of the cause which produced it. The liability to wound the intestine during the operation exists equally in every kind of strangulated hernia. In the operation, fresh difficulties may present themselves even after the stricture has been divided; viz. in returning the intestine into the abdomen. The difficulties here may arise from the quantity of intestine protruded, from its distention with flatus, its abnormal thickening, or its adhesion to the hernial sac.

In September, 1837, I operated at Guy's Hospital on a young man who was admitted with strangulated inguinal hernia. No difficulty occurred during the operation until after I had divided the stricture, when I found it totally impossible to return the bowel into the abdomen. I punctured the intestine with a grooved needle, to let off the gas with which it was distended, and the patient was put to bed, the head and lower extremities being raised, and the tumour covered by a light cloth kept constantly wet with warm water. After he had been two hours in bed, he passed a large quantity of flatus per anum, and my dresser then succeeded in replacing the intestine. The man died, however, in a few days, of peritonitis, the contents of the bowels not having been evacuated. A post-mortem examination was made, but no cause could be found for the difficulty in returning the hernia: the stricture had been freely divided, and there were no adhesions of the intestine, but it was much thickened, and had become inelastic and of a leathery consistence. Mr. Porter, of Dublin, lately described a case to me, in which, after having opened the sac, and divided the stricture, he failed in every attempt to return the protruded intestine into the abdomen, and his patient died in three days with symptoms of strangulated hernia. On dissection, it was found that the colon and part of the ileum had protruded under Poupart's ligament, and that a portion of the ascending colon had fallen over the entrance of the ileum into the caput coli, so as to completely close the valve, and thus produce the symptoms of strangulated hernia, and prevent the return of the protruded part, as the air and other contents of the sac could not be pressed back through the ilio-colic valve. In August, 1841, one of my colleagues admitted a patient into the hospital who was suffering from a large strangulated scrotal hernia. The hot bath, ice, and taxis, were all tried without success, and, the operation being therefore determined on, the sac was laid open, and the stricture divided; but it was found that even then the intestine could not be returned into the abdomen, in consequence of its being enormously distended with fluid: this was evacuated by a small puncture. The patient died, however, in a very short time. If adhesions be the cause of the difficulty in returning the intestine, they must be divided, whether they are to the omentum or to the sac itself, and I have not found this operation so difficult as we might expect, as the adhesions are usually of recent formation. They may, however, be so firm and extensive that an attempt to divide them would be unjustifiable. The intestine must, under these circumstances, be left in the sac, and of course remains, in that case, under the form of an irreducible hernia. The prognosis is then very unfavourable.

In the cases I have just described, where, owing to its great distention, the bowel could not be returned, I believe that it is better practice not to puncture it, either for the evacuation of air or fluid; but after the stricture is freely divided, the patient should be placed in bed, and the protruded intestine covered with linen dipped in warm fomentations, leaving it to the chance of spontaneous action, in which case it would be easy to return the protrusion into the abdomen.

Oscheocele, or *scrotal hernia*.—When a hernia has passed through the external ring and issued from the inguinal canal into the scrotum, it is no longer termed a bubonocele, but takes the name of oscheocele: it is, in point of fact, placed under different anatomical circumstances, as it does not receive any covering from the tendon of the external abdominal oblique muscle, but has acquired new ones from the cremaster muscle and fascia spermatica externa. The latter can scarcely, however, be regarded as a fresh covering, as it is a continuation of the superficial fascia of the abdomen, proceeding downwards into the scrotum: by its close connexion with the circumference of the external ring, it constricts it exactly as the internal ring is constricted by the fascia spermatica interna.

The coverings of a scrotal hernia are,—skin, superficial fascia, and cremaster muscle; these are its extrinsic, while the fascia spermatica interna and peritoneal sac form its intrinsic coverings.

An oscheocele is liable to become strangulated, and must be then subjected to precisely similar treatment to that in bubonocele. The taxis is to be applied in the same manner and in the same direction, the object being to push the viscus back along the course of the inguinal canal, and through the internal abdominal ring, into the abdomen. If the reduction cannot, however, be effected, an operation must be employed for the relief of the strangulation.

The operation is commenced by making an incision through the skin along the neck of the tumour, beginning immediately below the external abdominal ring, and being continued downwards for about an inch and a half, first cutting through the skin; the superficial fascia must next be divided to an equal extent: this must be done with great care, and the dissection continued in depth until the fibres of the cremaster muscle are brought into view. As the fascia is divisible into layers, there may be some difficulty in recognising the cremaster muscle; this is, however, a very important point, as it exactly indicates to the surgeon the progress he has made in the operation. When the cremaster muscle is distinctly recognised it must be cut through, and the fascia spermatica interna will then be reached, which is to be very cautiously opened, and a director passed upwards as far as the stricture. The director, being between the fascia and the peritoneal sac, is to be insinuated beneath the stricture; and, when brought into the proper position, the groove being directed forwards, the hernial knife is to be passed along the groove, and the stricture divided in the same manner as described when speaking upon the subject of bubonocele. The seat of the stricture in strangulated scrotal hernia is generally at the internal ring, but the latter does not, as in bubonocele, remain in its normal position midway between the anterior and superior spinous process of the ileum and pubes, but is forced downwards by the tumour until it is brought into close proximity to the external ring; so that, in dividing the stricture, there is no necessity for laying open the inguinal canal, as would be requisite if the rings were not brought so close to each other. If, after the stricture has been divided externally to the peritoneum, the sac cannot be emptied, it must be opened, in order to remove the obstruction which prevents the reduction. Oscheocele is sometimes congenital; the testicle will then be found descended into the scrotum, instead of remaining in the inguinal canal, as is frequently seen in bubonocele.

No difficulties offer themselves in this kind of oblique inguinal hernia (a scrotal hernia) beyond those which have already been described in "bubonocele," unless we admit the great liability of an increase of size in the hernial tumour when it has reached the scrotum, as offering a peculiarity. If a scrotal hernia has acquired a great size, the hernial sac should not be opened, but the stricture freely divided, and the sac emptied of its contents, if practicable; but if this cannot be effected, an opening just large enough to admit the director into the sac should be made, and, the director being passed upwards into the abdomen, the neck of the sac should be divided, and the finger gently introduced to seek for any adhesions which may prevent the bowel from being returned; should its reduction prove impracticable, it is better for it to be left in the scrotum than for the whole sac to be laid open. Hydrocele or hæmatocele of the tunica vaginalis may be concomitant with scrotal hernia, and lead to some diagnostic difficulties; or a complication of a direct with an oblique inguinal hernia might possibly occur; so that it is always judicious, after the intestine seems to be reduced by being pushed through the external ring, to examine whether any tumour still remains in the inguinal canal.

A very curious case of hernial complication occurred to me in consultation with Mr. Francis Toulmin, of Hackney. He consulted me about a patient who was suffering under symptoms of strangulated hernia. Upon making an examination a slight degree of fulness was felt in the right inguinal canal, but not giving from its appearance or feel, the evidence of a hernial tumour. It was determined, therefore, to give some calomel and opium to allay the sickness, and to wait the effect. The symptoms continuing the same, the next day we laid open the inguinal canal, to examine the cause of the slight protrusion in that region. As was expected, from the general character of the swelling, no hernial sac was found, nor did we discover any visceral protrusion, but what was regarded as a thickened and varicose spermatic chord. We therefore closed the wound, ordered some stimulus, as our patient was now become very low, and we considered that he was dying of some internal cause of obstruction. The next day, indeed, he died.

Mr. Francis Toulmin, twenty-four hours afterwards, made a post-mortem examination, and the following is his account of the investigation :—

"I send you herewith the right testis, with the appendix cæci and spermatic chord attached, and the result of my further examination of the body twenty-four hours after death. The skin was yellow; the abdomen tumid. Upon opening this cavity, the intestines *in situ* were deep in colour, and slightly glued together by recently effused lymph. I first examined the left internal ring, and found it would easily admit the point of the finger from the abdomen into the inguinal canal, which contained nothing abnormal. Upon laying open the right inguinal canal completely into the abdomen, for it had already been laid open by operation before death, the appendix cæci vermiformis was found passing through the internal ring and inguinal canal, and, terminating by a bulbous extremity, was adhering firmly to the right testicle, which was situated just below the external ring: the spermatic chord took its course behind the appendix cæci, and they were firmly adherent to each other. About eighteen inches of the intestinum ileum, forming numerous intricate convolutions, were firmly bound down to the rectum by a considerable quantity of plastic lymph, forming a mass which completely filled up the cavity of the pelvis. On separating, or rather, unravelling this mass, some pus flowed out. About six inches of the intestine was completely empty, contracted and almost impervious."

From the history of the symptoms in this case, as well as from the post-mortem examination, it is quite clear that the protrusion of the vermiform process of the cæcum was not the cause of obstruction to the bowels, but the adhesion of the small intestines to each other. One of the strongest proofs of this fact is, in my mind, the urgency of the sickness, which constituted a prominent feature; while, had protrusion of the cæcum been the only exciting cause, vomiting would have been merely a secondary symptom.

LECTURE XL.

Direct inguinal hernia, or internal inguinal hernia—Difficulty in diagnosis—Anatomy of—Operation for—Case.
Femoral hernia—Peculiarities of—Diagnosis—Coverings—Conditions of—Taxis—Operation—Variation in the course of the epigastric artery—Case—Prognosis—After-treatment—Difficulties which may present themselves during the operation—Cases.
Umbilical hernia—Its characters—Operation—Mr. Key's plan—Modification of—Cases—After-treatment—Ventral hernia—Situation of—Steatomata may be mistaken for ventral hernia—Operation for strangulated hernia—Prognosis.

Direct inguinal hernia.—It is not necessary that a scrotal hernia should pass through the internal abdominal ring, as it may protrude at once from the cavity of the abdomen, through the external ring: this is called a *direct inguinal hernia,* or, from being placed on the inner side of the epigastric artery, is sometimes termed an internal inguinal hernia: the former term is, I think, the most appropriate. It is very difficult to distinguish a direct from an oblique inguinal hernia during life: this difficulty arises from the descent of the internal ring in the oblique hernia, so that all obvious obliquity in the direction of the swelling is lost: usually, however, a direct hernia may be recognised from the absence of the pyramidal form, and from the part which should form the neck being enlarged into a broad base above the external ring, and being placed immediately on the outer side of the spermatic chord, which, in an oblique inguinal hernia, is covered by the tumour. The want of a correct diagnosis is not, however, important as to treatment; for the direction of the taxis in either kind of scrotal hernia must be towards the external ring; and if it be oblique hernia, the proximity of the two rings would do away with any necessity for obliquity in the direction of the force employed for the reduction. A direct inguinal hernia in passing through the external ring pushes before it the united tendon of the internal oblique and transversalis muscles, as this tendon forms the posterior wall of the inguinal canal, and strengthens the abdominal parietes immediately behind the external ring. The posterior surface of the tendon is covered by the internal abdominal fascia, in its course downwards behind Poupart's ligament to form the anterior layer of the sheath of the femoral vessels. The principal anatomical point connected with a direct inguinal hernia, is the position of the epigastric artery, which lies on its outer side, and that of the spermatic chord, which is somewhat posterior and also external to it. Should the attempt to reduce this kind of hernia by the taxis fail, the operation must be resorted to, as in every other case of strangulated hernia.

Operation for direct inguinal hernia.—The parts to be first cut through in this operation are the skin, external spermatic fascia, and cremaster muscle; the latter, however, if the hernia be large, would probably only cover the outer portion of the tumour, and in that case might be turned off the subjacent coverings without using the knife: the tendinous structure of the internal oblique and transversalis muscles would thus be exposed, and must be divided, and with it (I think almost unavoidably) the internal abdominal fascia. When these various tissues are cut through, the stricture may be liberated with similar precautions to those already mentioned; but, in addition, particular care must be taken not to give any outward direction to the knife, in consequence of the characteristic position of the epigastric artery. If the contents of the sac cannot be returned when the stricture has been divided, the sac must be laid open, as in the operation for oblique inguinal hernia. I have already mentioned that there is considerable difficulty in distinguishing a direct from an oblique inguinal hernia; and even after the operation this difficulty may not be removed; for if the united tendon of the internal oblique and transversalis muscles be much attenuated, or if it gives only a partial covering to the hernia, it may escape detection, and the hernia would then present no specific character.

Among the numerous operations which I have performed for this complaint, I have on two or three occasions had some doubts, both before and after the operation, as to the true nature of the hernia; and not having an opportunity of post-mortem examination, was unable to clear up the point. The following case, however, seems to me one in which there can be little question as to the course of the protruded bowel.

A patient was admitted into Luke's ward, with a small irreducible scrotal hernia, on the right side. Mr. Hilton had seen the case, and thought it one of direct inguinal hernia. I was called to the case, and upon examination found a small round firm tumour, scarcely projecting through the right external ring, and not in the least extending outwards into the inguinal canal: as the patient was suffering under all the symptoms of strangulated hernia, and as I was unable to reduce the swelling, I proposed the operation, which was consented to, and immediately performed. On cutting through the skin and superficial fascia, some few fibres of the cremaster muscle were seen covering the outer half of the swelling; these were easily turned downwards and outwards, without the aid of the knife, and a distinct tendinous surface exposed: upon dividing this, the sac was exposed to view, and I opened it, relieved the stricture, and easily reduced the hernia: the patient was in a few days convalescent. I have no doubt in this case I divided the internal abdominal fascia, (the fascia transversalis of Sir Astley Cooper,) at the same time I cut through the tendons of the internal oblique and transversalis muscles.

A direct inguinal hernia is usually very small, owing to the resistance of the tendon of the internal oblique and transversalis muscles; this resistance is so great as sometimes actually to prevent the protrusion of the tumour through the external ring; in a few cases the fibres of the tendon have given way, and the hernia passed between them: under such circumstances, there would arise still greater difficulty in recognising the hernia as a direct one, owing to its appearing without its characteristic tendinous covering. When a direct hernia arrives at a large size, it projects below the free edge of the tendon of the internal oblique and transversalis muscles, so that only the inner and upper half of the tumour is covered by it; but the partial tendinous covering is sufficient to mark the direct character of the hernia. The great distinctive peculiarity of direct inguinal hernia is, however, the position of the epigastric artery; and unless the operator be well acquainted with the course of that vessel in relation to the seat of stricture, he would be very likely to wound it: and it is to avoid doing so, that, in the operation, the incision should always be made directly upwards.

Femoral hernia.—This is sometimes also termed a merocele, or crural hernia. In femoral hernia the protruding viscus passes down behind Poupart's ligament into the thigh; it may easily be distinguished from inguinal hernia if the swelling be of small size, as it is seen distinctly below Poupart's ligament; but if it be large it first projects forwards and then upwards, over Poupart's ligament, strongly resembling an inguinal hernia; as it can, however, be readily pushed down completely into the thigh to the outer side of, and below, the spinous process of the pubes, its true nature may be ascertained with certainty.

The opening by which a merocele passes from the cavity of the abdomen into the thigh, is that, through which the femoral vessels also pass; these vessels are covered by the internal abdominal fascia, which tissue furnishes at the same time a covering to the hernia. The protrusion, it will be perceived, has nothing to do with either of the abdominal rings, going directly to the thigh, not passing through but under the abdominal parietes. Its coverings are skin, superficial fascia, internal abdominal fascia, and peritoneum: it does not obtain a covering from the fascia lata, as it protrudes through the opening left in that tissue for the ingress of the saphena major vein. Sometimes, however, a few bands of fascia pass across from the iliac to the pubic portion of the fascia lata, and may perhaps be considered as forming somewhat of a covering to the hernia, but they would offer no obstacle to the course of the operation.

Femoral, as well as every other kind of hernia, may present itself under one of the forms—*reducible, irreducible,* or *strangulated.* In order to discover whether the hernia be reducible, the taxis must be applied; and this may be done immediately, unless there exists some reason for first submitting the patient to the warm bath, and applying ice to the swelling: such a delay would, for instance, be advisable, if the tumour were tender, and the skin very tense. The direction in which the taxis must be applied is quite different in femoral and inguinal hernia; the object in the former is, first to direct the tumour into the thigh, and then to press it backwards through the saphenous opening; and it is not until this is accomplished that any attempt should be made to push the contents of the sac upwards behind Poupart's ligament into the abdominal cavity. When the hernia is reduced, the treatment is precisely similar to that in inguinal hernia; but should it remain irreducible, both constitutional and local means must be employed to prevent it from becoming obstructed; and if strangulated, the operation, as in the other kinds of hernia already spoken of, is the only means of giving relief to the patient. The operation in this case differs, however, so much from that in inguinal hernia, as to demand a particular description.

Operation for strangulated femoral hernia.—The first step in this operation is to make a horizontal incision through the base of the tumour, and a vertical one from the upper part of the tumour, to meet the first cut at its centre (⊥), being intended to divide the skin only. This is the form of incision which Sir Astley Cooper always employed in femoral hernia, but I do not insist upon its being invariably adhered to, as any incision through the skin which affords sufficient space for the subsequent steps in the operation, may be found equally efficient. The second step of the operation consists in dividing the superficial fascia in the same direction as the incisions through the skin; and if any of the fibres of the fascia lata, which I have spoken of as sometimes forming a partial covering to this hernia, be seen, they must be carefully divided so as to ensure the complete exposure of the internal abdominal fascia (the "fascia propria" of Sir Astley Cooper). This intrinsic covering is to be taken up by the points of a pair of forceps, and an opening, only just large enough to admit of the passage of a director, made with a sharp-pointed knife: the fascia may then be more completely laid open, when a quantity of fat is usually met with; this must not be mistaken for omentum, which it cannot be, because the hernial sac remains yet unopened. The director must next be passed between the hernial sac and the internal abdominal fascia, being first pushed deeply into the thigh, and then upwards towards Poupart's ligament. In its upward progress some resistance will be experienced, in proportion to the tightness of the stricture; the director must, however, be insinuated beneath the point of constriction, and the hernial knife being passed along the groove into the cavity of the abdomen, its cutting edge is turned forwards, and the stricture divided by giving the knife an upward direction. This precaution, as to the direction in which the cut is made, is highly necessary, for the purpose of avoiding the epigastric artery, which lies on the outer side of the stricture. In the normal arrangement of the parts, the epigastric artery can scarcely be considered in danger; but it sometimes happens that that vessel is given off from the obturator artery; and when this is the case, it must cross exactly over the part of the tumour subjected to constriction, and could then hardly escape being wounded during the division of the stricture. To avoid this accident, I always pass my finger along the director, while it is under the stricture, to feel for the pulsation of the artery before I use the knife. If I detect the presence of the vessel, I do not divide the stricture by the knife, but by the finger-nail, or a blunt instrument not likely to wound the artery. The internal abdominal fascia, or fascia propria, is always, in my opinion, the seat of the constriction in femoral hernia, and neither Poupart's nor Gimbernat's ligament, as many surgeons believe. I once had a very strong demonstration of this: I was performing the operation for femoral hernia, intending to divide the stricture externally to the peritoneal sac, and having, as I believed, divided the stricture, I attempted to reduce the hernia; I could not, however, succeed; but still feeling unwilling to open the peritoneum, I divided some fibres of Poupart's ligament, and afterwards Gimbernat's ligament, but both without effect. My only alternative now appeared to be in opening the sac; and cautiously proceeding to do so, I found that I had not yet exposed it, the fascia propria remaining intact. I at once divided the fascia at the usual point of stricture, and the hernia was directly reduced; in this case, at any rate, proving that the seat of the stricture was in the internal abdominal fascia. As far as my experience has gone, I should say that the prognosis in femoral hernia is more favourable than in any other species, particularly when the stricture is divided externally to the peritoneal sac; a modification of the operation which, indeed, I have found more easily effected than in the other kinds of protrusion. The after-treatment of femoral hernia does not in any respect differ from that in the inguinal: purgatives must not be employed, but the bowels left to their natural action; as the peristaltic motion produced by cathartic medicines interrupts the progress of the restoration of the parts.

It may be well to describe here some of the difficulties which may be encountered in cases of femoral hernia; and I shall do my best to point out the means which are to be employed to avoid and overcome them. In the first place, we must be cautious in our diagnosis, and, however certain as to the true nature of the tumour, always commence the operation rather with the deliberation of one about to enter upon an exploration, than with that confidence only admissible under circumstances of indisputable certainty.

Although it is easier to distinguish a femoral than it is an inguinal hernia, yet there may be abnormal conditions relating to the seat of femoral hernia which complicate its diagnostic marks. An enlarged gland in the upper part of the thigh concomitant with sickness and obstruction in the bowels, may offer great difficulty as to the mode of proceeding. If, under these circumstances, the symptoms be of recent occurrence, and delay therefore admissible, internal remedies may be first had recourse to, and the taxis employed; but should the obstruction have existed for a considerable time, and the patient be in danger, an exploring operation should not be delayed. Supposing an enlarged gland be exposed, it should be removed, and the investigation continued; for it is very probable that, under the circumstances described, a hernial tumour may yet be discovered behind the enlarged gland. Sir Astley Cooper mentions a case, in his published lectures, of a patient being admitted into Guy's Hospital, with a strangulated femoral hernia, to which he had had a poultice applied for three days, under the supposition that it was a bubo. When the operation was performed, the intestine was found in a state of gangrene, and the patient died. Another case is mentioned, in which a surgeon not only poulticed, but also opened a femoral hernia, believing it to be abscess, and the patient died two days after. I witnessed the same mistake in Norwich, several years ago; but in that case the patient survived, and an artificial anus proved only a temporary inconvenience.

Psoas abscess and femoral hernia may co-exist, and should exploration be necessary from the continuation of hernial symptoms after proper remedies have been ineffectually administered, the surgeon is not only justified, but bound to investigate the nature of the swelling by exploration. Varicose veins, or tumours of any kind in this region of the thigh, may lead to the necessity for similar treatment as in the cases alluded to. I must again also caution you, gentlemen, not to confound inguinal with femoral hernia; for neither the taxis nor the surgical operation for the division of the stricture is applicable to either indiscriminately.

In making the first incision, without due caution you might easily wound the saphena major vein; you should therefore always ascertain beforehand the precise position of that vessel. Immediately under the skin you may meet with some difficulty, in consequence of the presence of enlarged absorbent glands, which may require to be removed to enable you to prosecute the further steps of the operation. The fascia superficialis you will also sometimes find thickened, at others attenuated, and you should be prepared for this variation, or you may in some cases hardly recognise the structure when exposed to view, and may go on dividing the fascia into several layers, so as to complicate the operation, and preclude the possibility of knowing how far you have proceeded. The laying open the sheath of the femoral vessels is in all cases a difficult part of the operation, as that tissue is not very easily distinguished, either from the superficial fascia or from the hernial sac. Usually, however, a large vein will be found between the sheath and the superficial fascia, and some fat between the sheath and the sac (the peritoneum); but where neither be present, great caution is required in this part of the operation. The division of the stricture is very embarrassing to a young operator, from the great depth of the constriction, and in passing the director under it, it must be pushed deeply backwards into the thigh, before it is directed upwards under Poupart's ligament. In femoral hernia I have found the division of the stricture external to the sac more frequently effective than in inguinal; but it requires some caution, in pushing the contents of the sac into the abdomen, to prevent the sac and contents from all going up together ("en bloc"), thus converting an external into an internal hernia—a result which would most probably terminate fatally. Even in the common application of the taxis only, this has been known to result. If compelled to open the sac, you will generally find a considerable quantity of fluid escape, sometimes before, but more frequently after the stricture has been divided. I have seen so much flow out as to give rise to some apprehension that the intestine had been wounded—an accident more likely to occur in femoral than in any other species of hernia.

Umbilical hernia, or *exomphalos,* is a protrusion of a portion of the contents of the abdomen through the umbilical ring: it is subject to exactly the same conditions as other herniæ—that is to say, it may be either reducible, irreducible, obstructed, or strangulated: it is more especially liable to obstruction. If common precaution be exercised at an early period of protrusion, all ill effect may easily be prevented; for it is generally reduced with ease, and the simplest mechanical means are sufficient to retain it within its cavity. Infants are most liable to this hernia, owing to the large size of the umbilicus at that early age: even at birth umbilical herniæ are not by any means unfrequent. The congenital tendency may, however, be easily overcome by judicious management.

The parts called the umbilicus are in a different condition to every other part of the human body: the navel is, indeed, merely a cicatrix produced by the healing of an opening through which in fœtal life an apparatus had passed, for the purpose of maintaining a communication between the mother and child. At the time of birth the umbilical cord is severed close to the infant, and as the divided part heals it leaves a permanent cicatrix, which always remains a weak point in the parietes of the abdomen. At its commencement an umbilical hernia usually presents a rounded projection at the navel, but in thin persons it soon acquires a pendulous character. The neck of the hernia is usually above the centre of the umbilical ring, and consequently also above the remains of the umbilical vessels. The coverings of this hernia are—skin, superficial fascia, internal abdominal fascia, and peritoneum; but if the hernia be very large, and has existed for some length of time, the cicatrix of both the superficial fascia and internal abdominal fascia may have become completely absorbed; and in that case the skin and peritoneum would alone be left as the hernial coverings: hence, it is obvious that the greatest care is necessary in making the first incision in the operation for strangulated umbilical hernia.

The operation is commenced by making a vertical incision two and a half or three inches in length, according to the size of the tumour. The incision must commence above the tumour, about one half its length being in the linea alba, penetrating through the skin and superficial fascia, and the other half extending along the tumour itself, dividing the skin over the protrusion. When this is accomplished, the linea alba must be laid bare as far as the upper section of the first incision extends; the tendon must be carefully perforated, and the director passed between it and the internal abdominal fascia downwards to the umbilical ring; the internal abdominal fascia is then to be opened and the director passed on between it and the sac down to the hernial tumour. The hernial knife is then introduced along the groove of the director, or upon the finger (the latter is perhaps the safer and more convenient method), and the stricture cautiously divided. When the constriction is relieved, the sac should, if possible, be emptied of its contents, but never itself opened, unless in cases of extreme necessity. To my late colleague, Mr. Key, is due the credit of having devised the plan of passing the director through the linea alba above the hernia, so as to divide the stricture by an incision made from above downwards, instead of commencing from below: by this means we gain the important advantage of exposing with certainty the internal abdominal fascia, and securing the division of the stricture, without risk of injuring the peritoneal sac—an accident which is almost unavoidable if the operation be performed in the usual manner. I always adopted Mr. Key's plan until, having in one instance failed to empty the sac after I had divided the stricture, I continued my incision upon the tumour, intending to open the sac itself; but as soon as I had exposed the sac, by cutting through its fascial covering, it suddenly became flaccid, and the contents were readily returned. Since this case I have so far modified Mr. Key's method as to continue my incision through the internal abdominal fascia along the upper portion of the tumour, and I believe that the division of the skin from the circumference of the umbilical ring facilitates the liberation of the stricture, and tends also to set free the neck of the hernial sac: at any rate, I should strongly recommend, that, where Mr. Key's method does not succeed, the effect of prolonging the incision should be tried before the sac be opened, as it is in opening that membrane that the greatest danger is to be apprehended; this is perhaps more the case in umbilical than in any other kind of hernia.

Some time since I was requested by Dr. Williams, of Tavistock-square, to visit a lady about 60 years of age, weighing at least twenty stone, who was the subject of a large umbilical hernia which had been irreducible for many years, and had become either strangulated or obstructed five days before. The case was rendered somewhat complicated by the existence of a large inguinal hernia in the right side; but the latter was reducible, and free from pain or tension. I therefore proposed operating on the umbilical tumour, which was consented to. I made my incision in the course of the linea alba an inch and a half long, terminating half an inch above the tumour; this exposed the internal abdominal fascia; I made an opening into it, and passing my finger between it and the peritoneum downwards to the point of constriction, divided the stricture, but was still unable to empty the sac. I therefore continued my external incision through the skin for the remaining half-inch, and also for an inch on the tumour itself; and the moment I had divided the abdominal fascia of the hernia, the sac became flaccid, and a large portion of its contents receded into the abdomen. Two hours after the operation the patient had a copious motion, and a second shortly after, without the use of purgatives; but on the third day symptoms of sloughing omentum came on, and on the ninth day after the operation the patient died.

Sept. 29, 1837, I operated on an old woman, aged 79, at Guy's Hospital, for strangulated umbilical hernia, of which she had been the subject for fifty years, but, three days previous to her admission, a fresh portion had descended and become strangulated. I did not open the sac, and could not relieve the stricture until I had divided the abdominal fascia covering the hernia itself, as in the last case; but directly this was effected, the protruded intestine was readily pressed back into the abdomen, and the patient recovered without a single bad symptom.

Some years ago I saw Mr. Callaway operate for umbilical hernia on a woman aged 55, who had had fifteen children. The tumour was of very large size, and the greater part of it had existed for upwards of twenty years, but a fresh portion had descended four days before her admission into the hospital. The swelling felt as hard as if it contained some solid viscus, and was so large as to occupy the middle third of the abdomen; the upper portion was soft, and seemed to contain the newly protruded intestine; the larger and harder portion was believed to contain consolidated omentum. We considered it a very unfavourable case for the operation; but Mr. Callaway felt it right to give the patient the only chance there was of saving her life. He commenced his operation by making an incision vertically along the upper third of the tumour; and, cutting through the skin, an inch in depth of fat, and the superficial fascia, he was enabled to raise the tumour sufficiently to expose the umbilical opening and the neck of the sac, covered by the internal abdominal fascia. Through this fascia he made a small opening (leaving the peritoneal covering intact), and then divided the stricture, at the same time enlarging the umbilical ring for nearly an inch. The hernial sac, however, remained as tense as before: he therefore passed the probe-pointed bistoury again between the sac and the internal abdominal fascia, and, cutting downwards along the tumour, freely laid open its fascial covering, when the sac became at once relaxed—satisfactorily proving that the stricture resulted as much, at any rate, from the fascial covering of the hernia as from the fascia of the ring itself. Although this patient had alvine excretions, she sank the next day; but a post-mortem examination was not permitted.

The after-treatment of umbilical hernia is similar to that which is followed after the removal of the mechanical cause of obstruction to the intestines in every other species of hernia; the patients, however, less frequently recover from the operation.

Ventral herniæ may occur in any part of the abdomen, but are more frequent in the tendinous than in the muscular parietes. When they occur in the course of the linea alba above the umbilicus, the symptoms usually indicate interference with the functions of the stomach. This has sometimes led to the supposition that that organ was itself protruded; but no record of any such phenomenon is to be found, and the disorder of the stomach depends upon its proximity to the protruded viscus, and from the dragging action of omentum upon it when either that structure or the colon constitutes the contents of the hernia. The only cases in which I have known the stomach to be the subject of hernia were when there existed malformation of the diaphragm; and, under those circumstances, I have seen both the stomach and the arch of the colon within the chest. Ventral herniæ sometimes traverse the linea semi-lunares, and are placed under precisely the same conditions as when they perforate the linea alba, the disturbance experienced in the functions of the intestines forming the diagnostic marks in both cases. It sometimes happens, however, that small fatty tumours (steatomata) are formed in different parts of the abdominal parietes, and these may easily be mistaken for hernial protrusions, especially if they happen to be concomitant with any interruption to the function of the bowels; and if in that case the medical treatment failed to restore the bowels to their healthy condition, it would be proper to cautiously cut down upon the tumour to investigate its character. It is stated that steatomata may always be recognised by their doughy feel and lobulated form; but the existence of these physical signs ought not to prevent the exploration of the tumour under the circumstances I have mentioned; for, in addition to the abnormal formation of fat, there may be protrusion of intestine or omentum, and even the latter may cause all the symptoms of hernia.

When ventral herniæ are reducible, bandages or trusses must be worn to prevent their recurrence. If irreducible, they require some mechanical apparatus to prevent further protrusion, and to defend the parts from external injury. If strangulated, they require to be relieved by operation; similarly indeed to every kind of hernia. Ventral herniæ, however, differ in some degree from other abdominal herniæ in one respect: instead of passing, as the latter, through large natural openings, they project through small perforations normally intended only for the transmission of minute vessels, and which become sufficiently enlarged, from some accidental cause, to admit of visceral displacement. Ventral herniæ, however, like all other abdominal herniæ, derive a covering from the internal abdominal fascia. Operations for ventral herniæ are not often successful.

LECTURE XLI.

CONTINUATION OF HERNIA.

Obturator hernia—Characters of—Difficulty of detection during life—Ischiatic hernia—Characters of—Difficulty of detection—Case—Perineal hernia—Characters of—Seldom forms external projection—Most frequent in female—Case—Opening the sac in strangulated hernia—Operation—Treatment—Precautions in returning intestine—Wound of intestine—Treatment—Difficulty in returning the intestine after the sac is opened—Sphacelated omentum—Removal of dead part—Symptoms of gangrene—Treatment—Difficulty in returning the intestine in congenital bubonocele—Cases—Strangulated hernia, complicated with hydrocele—Case—Necessity for exploration—Hernia not always relieved by reduction—Case—Opening the cavity of the abdomen for exploration—Strangulation within the abdomen—Symptoms—Obstruction may exist either in large or small intestines—Case.

Obturator hernia indicates the protrusion of any viscus through the foramen in the obturator ligament, which forms a passage for the obturator vessels. This opening, in its normal state, is very small, and the tissue forming it extremely inextensible; the hernial protrusion itself can therefore be but small, and as it is very deeply seated on the upper part of the thigh, it is almost impossible that it can be discovered during life: indeed, I do not think that any case is on record in which this hernia has been found before the death of the patient. It consequently becomes a question as to the course the surgeon ought to adopt when the symptoms of hernia remain unsubdued by the application of the usual remedies, while at the same time no external tumour can be found to indicate the seat of the constriction. Even if, upon a very strict examination of the seat of obturator hernia, tenderness or any other circumstance should induce the supposition that protrusion has taken place at this point, the only means of obtaining the proof of this condition would be exploration, and this would be almost as dangerous as opening the abdomen; in an extreme case, however, the surgeon ought to decide promptly upon doing either one or other, to afford the patient the only chance of his life. The coverings of an obturator hernia consist only, strictly speaking, of peritoneum and internal abdominal fascia, for the skin and muscles of the thigh cannot be correctly considered as forming any part of the covering of this hernia. My colleague, Mr. Hilton, lately discovered an obturator hernia in a subject in the dissecting room; the protrusion was found not to have passed into the sheath of the obturator vessels, but above them, as is invariably the case in this description of hernia.

Ischiatic hernia is the protrusion of a viscus through the ischiatic notch, below the pyriform muscle; it accompanies, therefore, the great sciatic nerve. I believe there is no case known in which such a hernia was detected during life: but Sir Astley Cooper describes that in the dissection of a subject who had died of a strangulated hernia of seven days' standing, he discovered a portion of intestine behind the gluteus maximus muscle, strangulated at the point of its exit from the ischiatic notch: this hernia resembles in one respect the obturator hernia just described—viz., in being equally difficult of detection during life. A tumour of any kind situated in this region is very likely to be mistaken for a hernia, as it might be capable of both dilatation and motion in the act of coughing; and the presence of such a tumour, attended by interruption to the functions of the bowels, might lead to great complication and difficulty in the diagnosis. The late Dr. Lubbock, of Norwich, was consulted by a patient who had a large deep-seated tumour in the gluteal region. After examination, Dr. Lubbock determined upon removing the tumour, and proceeded to the operation; but, on making the first incision, he found that the cries of the patient created such an influence upon the tumour, that he mistook it for a hernia, and immediately closed the wound. About a year afterwards I removed this tumour, and found that it was fibrous, firmly fixed to both sacro-sciatic ligaments, and projecting partly into the ischiatic notch, which was sufficient to account for the effect produced on it by the act of coughing. If a hernia protruded through the ischiatic notch, it could not be discovered externally during life, and the only plan of proceeding would be exploration, as in cases of obturator and internal herniæ.

Perineal hernia.—This kind of hernia does not often form a sufficient external projection to produce a tumour, and rarely becomes strangulated; but it interferes with the functions of the rectum and vagina. Some mechanical arrangement is therefore required to remove or diminish this inconvenience, and the pessary or bandages are generally found effective. I have myself, however, no experience of this hernia, and believe, that as it most frequently occurs in the female, it generally falls under the care of the obstetric practitioner. Perineal hernia may, however, occur in the male subject; the intestines would then be placed in the pouch of peritoneum between the rectum and urinary bladder, and, protruding downwards into the perineum, would there form a hernial tumour; still this might not produce sufficient external tumour to be detectable in the living subject. Sir A. Cooper states, in his work on hernia, that he had once an opportunity of dissecting such a case, and found the hernia placed between the anus and the prostate gland. In that case the perineum externally presented a slight abnormal convexity, but not a distinct tumour. I believe that under symptoms of strangulated intestine, concomitant with perineal tumours, the perineum should be opened to seek for hernia, in preference to proceeding to abdominal exploration, as in this case the hernia would not be so easily reached. Should it, however, happen by any possibility, that either perineal or ischiatic hernia be detected during life, and effectual means employed to reduce them, bandages and compresses should be applied to prevent their recurrence.

In speaking of the operation for strangulated hernia, I have hitherto dwelt chiefly upon the division of the stricture external to the peritoneal sac, my object being to impress strongly the advisability of always first attempting that method of procedure. But this may not always be possible; I have now therefore to describe the circumstances under which the opening of the sac itself becomes imperative, and the difficulties that may at the same time present themselves. When, after the division of the stricture, the hernia still remains irreducible, it shows that the contents have undergone some change which tends to maintain them in their abnormal situation. To overcome this obstacle to the reduction of the hernia, the sac must be laid open: this operation requires great caution, for it not unfrequently happens that there are adhesions between the sac and its contents. When the opening is made, the omentum is generally first seen, and should the intestine lie in front, it is judicious to cover it with omentum, so that in passing the finger or director upwards towards the neck of the sac, the intestine may not be so much exposed to injury. If there be any obstruction to the passage of the finger through the neck of the sac into the cavity of the abdomen, it is evident that the stricture has produced a thickening or constriction of the sac itself; this might indeed have gone on to such an extent as to require division by the knife, which in that case should be passed upwards into the abdomen, guarded by the finger or director. In this operation there is great danger of wounding the intestine in passing the knife through the constricted part of the sac. To avoid this, I invented a knife, the cutting edge of which is protected by a slide, so that it may be passed with safety through the constricted neck of the sac, and then being exposed by withdrawing the guard, the stricture may be divided without danger to the intestine.

When the constriction in the neck of the sac is overcome, it must be ascertained whether the protruded bowel is in a fit condition to be returned into the cavity of the abdomen; if it be of a dark mulberry colour, and does not change its appearance when the constriction is removed, the blood in its vessels must have become coagulated, and death of the part must consequently have supervened; if this be the case, it will also usually be found that the intestine has lost its natural elasticity, and pits upon pressure. If the bowel be in such a state, it would clearly be unfit to be returned into the abdomen, but I should hesitate before I laid it open, and should apply warm fomentations or a light poultice, in the hope that its restoration may be effected. Should this hope prove abortive, the bowel must be opened, and an artificial anus established. In any case in which there existed the slightest hope that the bowel still admitted of restoration, and that the blood in its vessels remained fluid, I should return it to the abdomen, as the restorative process is more likely to proceed when it is in its natural cavity, than if it remained in the hernial sac; and even should it subsequently sphacelate, adhesive inflammation would be set up from within, and preclude the liability to extravasation of the contents of the intestine into the peritoneal cavity. In returning an intestine under these circumstances, care should be taken that it is merely placed at the mouth of the neck of the sac, so that if extravasation should occur, the effused matter may issue through that outlet. Should it happen, notwithstanding every precaution, that the intestine be wounded in the division of a stricture, and the opening be very small, the edges of the wound should be taken up by the point of a pair of forceps, and a silk ligature passed round the small portion thus taken up; the silk will soon be covered by plastic matter, thrown out from the peritoneal coat, while the inflammatory action produces ulceration through the mucous membrane, and the silk is ultimately discharged by the intestinal canal. Sir A. Cooper mentions two or three cases where recovery was complete under this mode of treatment. If the opening into the bowel be of any extent, it would not be safe to include the whole of it in a ligature, for by doing so the calibre of the injured intestine would be very much diminished. When the wound is therefore too large to be thus secured by ligature, it should be closed by means of the uninterrupted suture; but I should in that case recommend that the intestine be not returned into the abdomen, but either that it be left in the sac or confined by a stitch to the mouth of the opening; for should any portion of the suture give way before the wound is covered by the action of the adhesive inflammation, extravasation into the abdominal cavity, and consequent death of the patient, would be inevitable.

Some difficulty occasionally occurs in returning the intestine into the abdomen, even after the sac is opened, owing to adhesion having taken place between it and the sac, or between the intestine and omentum, or perhaps both: when this is the case, the adhesions must be carefully separated before the bowel can be returned. Returning the intestine and omentum together should always be avoided, as their adhesion to each other may prevent the bowel, even after it is returned, from performing its natural function. The condition of the omentum is as much a matter for the consideration of the surgeon, as that of the intestine itself; for by inflammation, the former, which is naturally a delicate and attenuated membrane, may be converted into a solid mass, totally unfit to be returned into the abdomen. It then becomes a question, whether the portion thus altered should be removed or left in the hernial sac. I think it ought to be left in the sac; for if it be removed by incision, it will be necessary to apply a ligature to stop the bleeding from the divided vessels, and that process is very likely to produce peritoneal inflammation: a further advantage is also derived from leaving it in the sac—it sometimes becomes adherent to the aperture through which it had passed, and thus prevents the future descent either of omentum or intestine. Should the omentum have become sphacelated, the dead part may be removed with safety, provided due care be taken to avoid the division of the vessels of the neighbouring living portion. It sometimes happens, that when living omentum has been left in a hernial sac, it will afterwards pass into a state of sphacelus, even although the external wound may have entirely united. This change is marked by a train of symptoms which clearly indicates the alteration which is taking place in the omentum; for notwithstanding the bowels continue to perform their natural office, the constitutional powers of the patient become suddenly depressed, the pulse feeble and irregular, and he is distressed by hiccup; the wound, which had healed, again opens, and a fœtid odour is emitted from it: poultices should be immediately applied to the part, the sloughing omentum removed, and chloride of lime, or a weak solution of chloride of zinc, employed to destroy the fœtor, and assist in the separation of the dead part. Tonics must also be administered; and if there be any tendency to sickness, carbonate of ammonia, in a state of effervescence, and combined with some narcotic, may be given.

A difficulty sometimes occurs, in congenital bubonocele, in returning the intestine into the cavity of the abdomen, in consequence of the testicle on the same side not having descended into the scrotum, occupying, in fact, the opening into the inguinal canal, through which the intestine has to be pushed back. I remember, in operating, many years ago, for a strangulated bubonocele, meeting with great difficulty in returning the intestine into the abdomen, although I had freely divided the stricture; indeed, the manipulation was so much protracted that I had some fear for the life of my patient: he speedily recovered, however, without any bad symptoms. Before commencing the operation for hernia, it is wise always to ascertain whether the testicles have descended into the scrotum; as their absence from their natural situation would prepare you for the difficulties which their abnormal position may give rise to during the operation. I was once present at an operation for strangulated hernia, where the surgeon, finding a second protrusion in the inguinal canal, persisted for some time in attempting to push it back into the abdomen; but at length he found that it was an undescended testicle, and that he had already returned the whole of the hernia.

The operation for strangulated hernia may be complicated by the co-existence of a hydrocele: and in a case in which we may have carefully dissected down to the tumour, an escape of fluid, and the sudden disappearance of the swelling, may lead to the supposition that a hydrocele had been mistaken for a hernia. Such a conclusion ought not, however, to prevent further investigation; the finger should be passed upwards to the ring, to examine if there be not some other tumour; as it may be that a hernia, in a distinct peritoneal sac, may be placed in front of the tunica vaginalis, or may, indeed, have passed down into it; in either case the hernia, unless it were liberated, would lead to the destruction of life. A patient consulted Mr. Colman, of Norwich, on account of a swelling in the right inguinal region, suffering at the same time from all the symptoms of hernia, which would not yield to the usual remedies, nor could the tumour be reduced. Mr. Martineau was called in consultation, and the operation for strangulated hernia was determined upon. Upon opening the membranous covering to the tumour by careful dissection, a quantity of fluid made its escape, which satisfied the mind of Mr. Colman that the swelling was not a hernia, and therefore he desisted from further exploration. Mr. Martineau, however, strongly recommended him to continue his search: but he neglected to do so, and the patient died without any abatement of the symptoms. On a post-mortem examination, it was found that a hernia existed at the internal ring, within the peritoneal covering of the round ligament, which had also contained the water that had been evacuated, constituting a hydrocele of the round ligament, complicated with hernia—a very rare disease. There can be no doubt that further exploration should have been made in this case, as the liberation of the strangulated intestine would have offered a fair chance of the patient's recovery.

As I have already stated in a former lecture, varicocele, abscesses, or indeed tumours of any kind, in the ordinary situations of herniæ, may be mistaken for them, especially when disturbance to the natural functions of the intestinal canal is concomitant with them. Should these symptoms prove insuperable, however dissimilar the physical conditions of the tumour may be to hernia, a minute exploration should be made, to establish beyond question either that it is connected with or independent of any abdominal viscus.

I have already alluded to the fact that the reduction of a hernia by the application of the taxis does not invariably relieve the symptoms; for if the sac be pushed back into the cavity of the abdomen, with the protruded viscus still within it, the only change is the conversion of an external into an internal hernia, the symptoms all remaining unmitigated. I attended a case with Mr. Fred. Toulmin, of Hackney, in which the patient had a reducible hernia in both inguinal regions, and was suffering from symptoms of strangulation. We returned the protrusion on the right side with the greatest ease; but on the left side some thickening still remained in the inguinal canal, even after the reduction of the hernia seemed complete; it was therefore determined that an exploration should be made to ascertain the cause of this abnormal condition. The result led to the discovery of a small portion of healthy omentum within the hernial sac, but it was easily returned into the cavity of the abdomen, without the necessity for dividing the internal ring; and although we had no reason to believe that this portion of omentum could have produced the urgent symptoms of strangulated hernia, as there was no other tumour in the right inguinal region, we could not proceed to any further exploration. The symptoms, however, remained; indeed, their urgency increased, and the next day the patient died.

On a post-mortem examination, it was found that the left hernia, upon which we had operated, presented what we had already discovered in the operation; but on the right side the nature of the case was perfectly explained by the existence of a double protrusion, the posterior of which was the reducible hernia, the sac still remaining in the inguinal canal and scrotum; but within the abdomen was found a second hernia enveloped in its sac, and still strangulated by it, and which no doubt had been returned "en bloc" by the application of the taxis.

The question arises, whether means should have been taken in this case to reproduce the descent of the hernia by exciting the patient to cough while in the erect posture; and if the attempt had succeeded, whether an operation ought not to have been performed, for the full investigation of the condition of the tumour: this might likewise have been effected by opening the abdomen, and making the examination from within; but the case was rendered doubly complicated by the existence of a hernia on the opposite side, giving rise to the idea that the obstruction was more likely to be external than internal.

The circumstances under which the cavity of the abdomen may be laid open to seek for an internal mechanical cause of obstruction to a bowel, may be considered as a matter still *sub judice;* but when we consider the danger inseparable from the operation, especially with an inflamed peritoneum, we shall perceive that it should be only had recourse to as a last resource, although it is quite clear, at the same time, that the chance of success must be diminished in proportion to the delay; the surgeon is, however, in some degree, justified in delaying such an operation, as many cases apparently reduced to the last extremity have recovered under nature's own reparative efforts. It is also a matter of uncertainty whether, upon laying open the abdomen, we may succeed in discovering the seat and cause of obstruction ; for, in consequence of the distention of the bowels, and the adhesions resulting from the inflammation, the manipulation necessary to separate these adhesions, so that the surgeon may arrive at the object of this search, would itself be sufficient to aggravate the symptoms to a degree likely to prove rapidly destructive to life. When abdominal exploration is determined on, I believe that the linea alba ought to be chosen as the point for the performance of the operation; for, although the locality of the symptoms may lead the surgeon to guess at the precise point at which the obstruction is situated, still, as you avoid the division of muscular fibre, and the liability to hæmorrhage, and have the advantage of the accurate knowledge of the relative position of the subjacent parts acquired by commencing the operation at one precise point, this region is the most appropriate for the operation.

When insuperable obstructions occur in the large intestines, as from stricture in the rectum, or in the sigmoid flexion of the colon, the operation necessary for the relief of the patient is the formation of an artificial anus. This is made by opening the colon in the posterior lumbar region, as has already been described, deviating in this case from the practice recommended in the exploration, where the point of obstruction is doubtful. The well-marked symptoms and history of the case, will, however, generally preclude any difficulty in forming a just diagnosis.

In concluding the subject of hernia, I ought, perhaps, to remark to you, gentlemen, that the result of operation, in case of strangulation or obstruction in irreducible hernia, is not by any means so successful as the pathological considerations connected with the disorder would lead us to expect. In great measure I believe this want of success to be attributable, firstly, to the delay on the part of the patient in seeking surgical relief; and, secondly, to the violence which is so frequently employed in the attempt to reduce the hernia prior to the operation. It is a matter, therefore, of the greatest importance, that before the taxis be attempted, the patient should be so prepared by constitutional remedies, local applications, and position, so that the least effectual degree of force only need be required to return the protruded part. The amount of force which may be safely employed it is impossible to describe, as it varies in every case, and can only be learned from an accurate knowledge of the part involved: it also depends upon the conditions of those parts, and the constitutional peculiarities of the patient. Such circumstances can only be appreciated by the experience gained from a long practical acquaintance with the subject. When the attempt at reduction of the hernia has failed, and all the force it is considered prudent to adopt has been employed, the operation should be resorted to without further delay,—as, by procrastination, such conditions are likely to supervene in the contents of the hernia as either to produce adhesion to the sac, or to render them unfitted to be returned into the abdomen. Either of these conditions would lead to the necessity for laying open the hernial sac—an operation which so much enhances the danger that delay in the early division of the stricture ought always to be avoided.

Strangulation of the bowels within the abdomen—Internal hernia.—Such a condition is, perhaps, the most difficult with which a surgeon has to contend. The symptoms commence with little to alarm the patient. Slight uneasiness in the bowels, and irregularity in their function, alone mark a deviation from health, and gentle purgative medicine is taken by the patient's own judgment; or if under the advice of a surgeon, it is prescribed often without a suspicion of any threatened danger. The medicine probably fails in producing its desired effect: the uneasiness in the bowels increases; the abdomen becomes somewhat distended; nausea supervenes; and the constipation remains unrelieved. The patient now becomes anxious, and the medical attendant is consulted in good earnest. Another kind of purgative is prescribed, probably a warm bath ordered, and enemata administered; but even as yet no alarm may be in any way excited. Still the bowels remain unmoved, and the distention and sickness increase, but the patient is relieved of his apprehension by the assurance of the surgeon that three or four day's constipation is a matter of frequent occurrence, and generally unattended by danger. The next symptom is probably a fixed pain at some particular point within the abdominal cavity, and the patient refers his complaint to that spot. Leeches are now ordered, and the warm bath repeated. Calomel and opium are prescribed: and if the patient be of a plethoric habit, a small quantity of blood may be abstracted from the arm, and a saline effervescent draught ordered to be taken every three or four hours, until the bowels are opened.

This desired result may not, however, be attained: the vomiting now becomes more and more urgent, and the matter ejected is probably stercoraceous. If such be the case, and the vomiting be the most urgent symptom, and the odour of the ejected contents of the stomach fœtid, a diagnosis may, in my opinion, at once be formed, that the obstruction is seated in the small intestines; for when the larger bowels are subjected to obstruction, sickness does not occur until towards the approaching end of the disease — not until, in fact, the colon becomes so distended between the point of obstruction and the ilio-colic valve, that nothing can pass from the small into the large intestines, and then, therefore, they reject their accumulated contents; but, as I have remarked in a former lecture, no regurgitation can, I think, take place through the ilio-colic valve, unless that organ be subjected to actual lesion, the feculent smell of the vomited matter merely arising from its retention in the smaller bowels. It may moreover be observed that if the source of obstruction be in the small intestines, inducing that pathognomonic symptom, constant vomiting, the abdomen remains flaccid; while, on the contrary, if the obstruction be in the large intestines, from the absence of the regurgitation of their contents, great distention of the abdomen constitutes a conspicuous indication of the seat of lesion. It has also been observed by Dr. Barlow, that when the small intestine is obstructed there is more or less diminution in the secretion of the urine in proportion to the proximity of the obstruction to the stomach, while the secretion of the kidney is unaffected if the large intestine be the seat of the disorder.

If, therefore, there be little or no sickness with this obstinate constipation, it is to be attributed to some altered condition of the large intestine, and the prognosis may be considered more favourable than when the small intestines are the seat of the disease. In such a case much benefit may be derived from the passing a long flexible tube into the rectum, to the very commencement of the sigmoid flexion of the colon, and large quantities of gruel and castor oil should be thrown up, so as to distend the arch of the colon. This may have the effect of unfolding some unnatural convolution, or of softening the hardened fæces, which it may retain; and, indeed, many instances are recorded by Dr. O'Bearne, of Dublin, in which this mode of treatment has proved effectual. In those cases where the small intestines are primarily affected, such means should not, however, be had recourse to, as they would only tend to irritate the intestinal canal, and increase the sickness.

Should the sickness and constipation remain, and the urgent symptoms still resist all the remedies which had been administered, what further is to be done? There is now every reason to believe that the obstruction is the result of some internal mechanical cause; and, in post-mortem examinations of cases which have terminated fatally, it is not uncommon to find such to be the case. Bands of plastic effusion sometimes surround the intestines so as to constitute an internal strangulation. Portions of bowel have been found protruding through openings of the omentum and mesentery; and also, in cases of reducible hernia, adhesions are occasionally formed just at the outlet through which the protrusion had occurred. Intus-susception may also lead to obstruction, or the vermiform process of the caput coli may become adherent to some other portion of the intestinal canal, leaving an opening through which a portion of bowel may pass, and become the cause of all the mischief. But such symptoms may arise from other causes, and from those which may be spontaneously removed by nature's processes—such as the presence of a foreign body within the intestines, hardened fæces, or perhaps spasmodic action of the muscular coat of the intestines; and it is on this account that surgeons are so little inclined early to propose exploration by laying open the cavity of the abdomen; therefore, where this mode of proceeding has been had recourse to, it has generally been at so late a period that little or no hope of success could be fairly expected.

I once witnessed the restoration of a patient to health after all the symptoms described from protracted constipation had existed apparently to the last extremity. The case is worthy of being related, as the cause, one would be led to suppose, was mere spasm:—

An elderly lady, residing at Norwich, was under the care of Mr. Colman, of that town, suffering from constipated bowels, having had no evacuation for four days. The usual purgative remedies were prescribed, but without effect; enemata and drastric cathartics were tried, but still ineffectually; vomiting and immense distention of the abdomen supervened, the symptoms became more and more urgent, and on the twelfth day from her attack she had had no relief from the bowels. Dr. Alderson was then called in, and was asked, after he had examined the patient, what purgative he would recommend; to which he replied, "None; but a large dose of opium." It was given, and in a few hours the bowels were freely opened, and the patient recovered.

Now in this case, had exploration been attempted, it is quite clear, not only that no benefit could have been obtained, but the operation would almost inevitably have proved fatal. It is such cases as these, therefore, I say, which tend to induce the procrastination of a surgical attempt at relief, until every hope is passed of nature being able to restore the function of the bowels, and until the operation itself is scarcely admissible; it is only in cases where no doubt can exist as to the cause of obstruction being mechanical, that laying open the abdomen should ever be recommended; and then the sooner it is had recourse to, the better for the patient.

I remember the case of an individual who was suffering under insuperable constipation, and in whom a swelling of considerable size in the right iliac region led the physician who attended him to suppose that the source of the obstruction was in the ascending colon. It was proposed to cut down upon the swelling through the abdominal muscles, and to puncture the cæcum, and thus establish an artificial anus. The surgeon called in consultation was not, however, convinced that the tumour was the distended cæcum, and doubted as to the propriety of making the incision on the tumour itself, but proposed to open the abdomen by an incision through the linea alba, which he preferred, in consequence of the greater room he would acquire for exploration. Ultimately, however, an incision was made over the cæcum, according to the original proposition, when it was found that the obstruction was not in the colon, but in the ileum, and produced by an adventitious band of plastic effusion—proving how difficult it is during life to ascertain the precise seat of mischief. The patient died in a few hours after the operation.

Mr. Hilton was called in consultation on a case in which a lady, aged 36, had been seized with all the symptoms of strangulated hernia, but no external signs of hernial protrusion could be detected. Various means had been ineffectually tried for her relief, but during the period of eleven days she suffered under all the symptoms of strangulation, and on the twelfth day Mr. Hilton opened the cavity of the abdomen, making his incision in the linea alba between the umbilicus and the pubes, when he discovered an obturator hernia, which there had been no reason to suspect, as such a protrusion had already been most diligently sought for. The operation was performed under the influence of chloroform. The patient died, however, on the same day. On a post-mortem examination, the portion of intestine which had been protruded showed the strongest evidence of a condition competent to restoration.

Does not this case sufficiently prove the necessity for the early operation for the relief of obstructed bowel, whenever that obstruction depends upon a mechanical cause? For, as the protruded intestine did not manifest any signs of disorganization, it necessarily leads to the belief that the general effect on the constitution produced the fatal result. Such effects, however, do not seem to be the consequence of a mere protracted alvine accumulation when depending on an abnormal change in the function of the bowels themselves —in fact, on internal causes; for the constitution in such cases seems better capable of maintaining some compensating action: for instance, how does it occur that patients will suffer constitutional constipation even for three weeks and more, and yet ultimately recover upon the restoration of the natural function of defæcation?

The symptoms which lead to the necessity for exploration require therefore to be more accurately observed and defined; and I believe it may be said, that, whenever severe sickness and a well-defined local pain constitute the early symptoms of internal obstruction—that is to say, whenever sudden and acute signs of strangulation occur, although unattended by any external signs of hernia—the absence of the physical proofs alone should not preclude the operation of exploration to those who advocate the propriety of such a step; for I believe, if the operation ever succeeds, it will be only when it has been performed before peritonitis has set in, or the constitutional powers are prostrated by protracted suffering.

LECTURE XLII.

DISEASES OF THE RECTUM.

Functions of rectum—Defæcation and nutrition. Prolapsus ani—Causes—Treatment—Constitutional and mechanical—Diagnosis between stricture of the rectum and piles—General treatment of piles—Bleeding sometimes the only symptom of internal piles—Removal by ligature—Method of exposing internal pile—Administration of opium—Removal of external pile—Excision—Use of rectum bougie.

Warty excrescences and condylomata about the anus—Syphilitic excrescences.

Fissure of the rectum—Cause—Constipation—Diagnosis—Cure by operation, and constitutional remedies.

The rectum may be regarded almost exclusively as an organ of defæcation, although it must be admitted that it assists in some degree in the process of nutrition; this is proved by the benefit derived from the administration of nutritious enemata. At the same time we find that in the diseases of this organ any disturbance in its functions as an excretory apparatus, calls much more urgently for surgical interference than any diminution of its absorbent powers. In describing the diseases to which the rectum is liable, I shall commence with that termed

Prolapsus ani; this is a protrusion of the mucous membrane of the rectum through the anus; it is a very common affection, and although not in itself dangerous, is very frequently the result of general debility, and must be considered as an evidence of serious constitutional derangement. Costiveness is perhaps one of the most frequent exciting causes of prolapsus ani, and in such cases it arises in great measure from the constant straining necessary to produce evacuation of the bowels, which is, indeed, generally attended by the passage of a quantity of blood. That straining is an exciting cause, is, in my opinion, proved by the circumstance that prolapsus ani is so often concomitant with stone in the bladder or stricture in the urethra; indeed, straining may naturally be looked upon as the cause of prolapsus, for, by a continuation of that action, the power of the abdominal muscles and levator ani is brought to preponderate so much over that of the sphincter, as to deprive the rectum of the support of the latter muscle; eversion and protrusion of the mucous membrane being the consequence. When costiveness is the cause of the prolapsus, purgative remedies are chiefly indicated; but if, in aggravated cases, these alone were relied upon, I do not think that we should easily succeed in removing the disease, and might, indeed, in many instances, greatly increase it. Strict attention to diet, change of air, tonic medicines, shower baths, and restringent injections into the rectum, are all requisite; such aperients alone being employed as tend gently to produce increased peristaltic action of the bowels, rather than to command it through the potency of the medicine. It is also highly important to induce a habit of evacuating the bowels shortly before bed-time, as the recumbent position of the body in bed relieves the rectum from the pressure of the small intestines, and admits of its ready return into the pelvis; while, if the bowels be evacuated immediately after breakfast, as is usually the habit, the erect position, and muscular exertion inseparable from the avocations of the day, prevent the rectum from receding, and tend, in fact, to increase the protrusion. In protracted cases of prolapsus ani, palliative means may not prove sufficient, and a mechanical contrivance may be required to return the protruded membrane within the anus: bougies, or the finger may be employed for this purpose; but in some instances the tone of the sphincter may be so completely destroyed that it would be incapable of retaining the intestine even after it is returned: a pessary should in that case be passed into the rectum, and allowed to remain there for a few hours, to maintain the loose portion of membrane sufficiently long *in situ,* to allow its recovery from the congestion arising from its protrusion and exposure. I have seen an instrument which is worn by the Chinese, who are very liable to prolapsus ani, for the purpose of retaining the bowel within the anus. It consisted of a ball of silver, perforated with holes, to permit of the escape of flatus, and made to unscrew in the middle, so that it could be easily cleaned: this instrument appeared to me to be admirably suited to the purpose for which it was intended. When a pessary is employed, it should be passed into the bowel above the sphincter muscle, otherwise it would produce increased irritation rather than relief. At the same time that mechanical contrivances are made use of, constitutional means should also be adopted for the purpose of improving the general health. In spite, however, of treatment the prolapsus may remain unrelieved; a surgical operation must then be performed, in the hope of effecting "a radical cure" of the disease. This object may sometimes be effected by pinching up a small portion of the mucous membrane of the bowel with a pair of forceps, and securing it with a ligature, taking care not to include anything besides the mucous membrane. In this manner two or three different portions may be taken up just above the sphincter at about equal distances from each other, and each being tied, the cicatrization will produce a very uniform contraction, and prevent future protrusion. In two or three obstinate cases I have divided the anal extremity of the sphincter muscle, for the purpose of permanently diminishing the size of the opening of the anus; the after-treatment consists in keeping the patient in the recumbent posture, and maintaining for a few days a constipated state of the bowels, to enable the parts to recover from the effect of the operation.

Prolapsus ani may in some cases prove dangerous to life; the following case affords a good example of the urgency of the symptoms which may appear under such circumstances:—A gentleman sent for me to visit him, in the neighbourhood of Croydon; when I arrived at his house, I found him labouring under the symptoms of strangulated hernia, so strongly marked that I proceeded at once to examine for the hernia, which I expected was the cause of his disorder. I could not, however, detect any external tumour to account for the symptoms, which were very severe, although I asked him repeatedly whether he was conscious of the existence of a tumour or protrusion in any part of his body: just, however, as I began to think that he was the subject of some internal obstruction, he remarked, "By the way, there is something queer about my fundament." Upon examining that part, I was astonished to find not less than three inches of rectum protruded from the anus; the protruded part was highly congested, and so dark in colour that I doubted whether sphacelus had not already commenced: I endeavoured to return the bowel, but the constriction at the anus was too great to permit of this; I then applied cold to the part, but this also proved ineffectual; and as relief was urgently demanded, I proceeded to make numerous longitudinal incisions in the mucous membrane to liberate the overcharged vessels; from the quantity of blood lost I was enabled to return the prolapsed intestine into its proper situation. This was a true case of strangulated hernia, under conditions quite new to my experience of the subject.

Prolapsus ani may, perhaps, be considered as too unimportant a disease to deserve the detailed account I have given of it; but although it is quite true that this complaint rarely proves dangerous, it is nevertheless a source of excessive inconvenience, and produces so much depression, that I know of no case in which the reputation of a medical practitioner is likely to be more enhanced than in its successful treatment.

Hæmorrhoids or Piles.—These painful tumours result from a varicose condition of the veins of the rectum; a state generally produced by some obstruction in the portal system.

It may be well to remark that the superior hæmorrhoidal vein returns its blood to the vena portæ, and if this becomes obstructed from disease of the liver, it would necessarily lead to congestion of the veins of the rectum: this anatomical fact teaches us that, in piles, the remedies may often be advantageously directed to the relief of the loaded liver. High living, want of exercise, or constipated bowels, frequently induce congestion of the veins of the rectum, and their consequent varicose condition; if this congestion become permanent, the blood within the veins coagulates, and acting as extraneous matter, excites inflammation in the surrounding submucous cellular tissue: adhesive matter is then thrown out, and unites the congeries of varicose veins into a solid mass, which constitutes a pile. It sometimes happens that some of the veins included in the adherent mass still contain fluid blood, and therefore slight hæmorrhage occasionally occurs. From these bleedings the patient may derive so much relief as to believe that the attack of piles has subsided; such relief is, however, generally but of short duration, as the vessels fill again, and produce a return of all the symptoms.

Hæmorrhoids, moreover, necessarily produce great obstruction to the passage of the egesta, and are sometimes forced down by the efforts of the patient during evacuation, so that they protrude through the anus, a condition which is often attended by considerable prolapsus ani; generally, however, upon the completion of the act of defæcation, both the hæmorrhoids and the prolapsed bowel spontaneously return into the anus. Sometimes the piles become so much elongated by frequent protrusion as to be rendered permanently external; and then, from exposure to constant friction and other sources of irritation, their mucous membrane soon becomes converted into true skin. It may be supposed that in this condition the hæmorrhoids would produce much less irritation, but such is not the case; for as they still remain connected with the interior of the rectum, they continue to excite considerable disturbance, and sometimes, becoming themselves inflamed, require leeches and strict dietetic treatment for their relief, it being also necessary that the patient should be kept in the recumbent position. External piles do not always appear as the mere result of the protrusion of internal piles, but are sometimes entirely independent of them, and arise from inflammation and thickening of the subcutaneous cellular tissue around the anus: these piles are apparently unconnected with a dilated condition of the veins, although originally the congestion of the latter may have produced the inflammation.

External piles, even when unattended by internal, frequently produce prolapsus ani, extreme pain in the course of the sciatic nerve, pain in the perineum, and in some instances even difficulty in passing the urine; nor are these phenomena inexplicable to the anatomist and pathologist when it is remembered that all these parts are supplied by filaments of nerves derived from the same source. The excision of the piles is an almost infallible means of removing all these symptoms. A short time since I was consulted by a patient in the Edgware Road, who was the subject both of internal and external piles: his medical attendant had tied several of the internal ones without affording any permanent relief; but when I removed the external hæmorrhoids he was rapidly cured. In another case, I was called to a lady, a governess in the family of a nobleman: part of her duties consisted in walking out with her pupils, but this exertion caused her so much pain that she was obliged to confide her condition to the elder of the ladies, and whenever they went out to walk she was in the habit of going to lie down at the house of a friend close by: this could not go on long, and she was obliged to seek medical aid. She told me a pitiable tale of her sufferings: the piles were external, and were attended by frequent bleedings, but after I excised them, she rapidly recovered. I remember also the case of a gentleman, who was very fond of hunting, but who was afflicted by piles to such a degree that his saddle was often wetted with blood: at length the disease became so bad that he was obliged to give up his favourite amusement. I then saw him, and after having excised the piles and treated him with enemata and laxatives, principally, however, insisting upon the necessity for always passing his motions at night, he very soon recovered, and it is now eight years since he had any symptom of his complaint.

Whether the piles be internal or external, they necessarily cause great inconvenience in the act of defæcation, and the fæces are generally passed in small portions, and often attended by a flow of blood: these symptoms are not referrible to piles alone, they may equally proceed from stricture of the rectum. It may, however, easily be ascertained, by an examination per anum, whether the symptoms are produced by piles or stricture. The first treatment of piles should always bear reference to the state of the patient's general health; for, as they usually depend upon some disturbance to the function of the liver and bowels, or both, until the healthy action of those organs be re-established there can be but little hope of removing the local disease. Small doses of mercury to act on the liver, and mild purgatives to excite a healthy action of the bowels, constitute the means to be employed; but the purgatives should be of the least drastic nature, and not likely to act especially upon the lower bowels. The nostrum termed "Ward's paste," and the Confec. Piper. Nigr. of the London Pharmacopœia, will be found useful; but if they should produce nausea, as they frequently do, I have found the following prescriptions of great use in restoring the natural action of the bowels:—

℞ Aloes decoc. co. ʒiss.
Sarsæ ext. ʒss.
Sarsæ decoc. co. ℥iss. M.
Ft. haustus ter quotidie sumendus.

Giving also an alterative pill two hours before dinner to induce evacuation of the bowels at bed-time. If the irritation still remains, so as to create an uncontrollable action of the bowels, considerable benefit will be derived from the use of the following pill:—

℞ Morph. acet. gr. $\frac{1}{8}$th.
Ext. hyos. gr. iss.
Camphoræ gr. ij.
Ext. colocynth co. gr. ij. M.
Ft. pil. bis terve quotidie sumenda.

For the reasons I have already mentioned in speaking of the treatment of prolapsus ani, the patient should resist as much as possible the habitual desire to evacuate the bowels in the morning. I believe there are but few cases of hæmorrhoids that would not yield to judicious constitutional treatment, if the patient did but apply earlier for medical assistance. Generally, however, he defers calling in the surgeon until the piles have gone beyond the reach of medicine; they require, therefore, a surgical operation for their removal. Bleeding is sometimes a symptom of hæmorrhoids, even when there are no external signs of the disease; and it is not uncommon for patients to become anæmiated from this cause, without their being aware of the nature of the complaint. When called in to such a case, an examination per anum should be made, and if an internal pile be discovered, it should be at once removed; for it would be injudicious to wait for the operation of constitutional remedies, as the hæmorrhage may recur to a sufficient extent as to endanger the life of the patient. When piles, either internal or external, present an organization which renders them incapable of being relieved by medical treatment alone, they must be removed by operation; but the plan to be adopted varies very essentially according to the kind of pile.

Internal piles, which are only covered by mucous membrane, should always be removed by ligature, in consequence of their tendency to bleed; and, indeed, I have known more than one instance of death from excision in such cases. There is, however, sometimes a difficulty in exposing the pile sufficiently to enable the surgeon to apply the ligature; this may generally be effected by causing the patient to sit over a hand-basin filled with hot water, and placed upon the floor, so that he is obliged to stoop or crouch over it. By some straining the pile will generally protrude, and the ligature can be passed around it: the mucous membrane and submucous cellular tissue must alone be included within the silk, and then the operation is attended with but little pain. If the base or root of the pile be very broad, the ligature may be applied by another method. A needle, armed with a double silk, should be passed through the centre of the tumour, and the threads, being separated, tied on opposite sides, each including one half of the pile. The latter should then be laid open by the knife, which affords great relief to the constriction, and is wholly without danger, as the ligatures preclude hæmorrhage. After the operation, the patient should be kept in the recumbent posture, upon low diet, and a dose of opium be administered, to keep up a constipated state of the bowels until the ligature has sloughed away. An external pile is better removed at once by excision: in performing this operation, the pile should be taken off by one sweep of the knife. If there be more than one pile to be excised, it is best to remove them all at the same time, as in that case the patient suffers less constitutional irritation than when each pile is made the subject of a separate operation. In thus removing piles, there is, however, one point that ought not to be lost sight of: the process of cicatrization will necessarily contract the verge of the anus; and unless some mechanical means be employed to obviate this, there would arise permanent difficulty in passing the fæces. Bougies should therefore be daily passed during the progress of healing, to prevent such contractions.

After the performance of this operation the surgeon must not be disappointed if for the first three or four days the patient seems to have received but little relief: indeed a fresh growth of piles sometimes appears to be formed; these generally prove, however, to be nothing more than folds of mucous membrane, which pass down probably in consequence of some tumefaction of that tissue. Such protrusions generally subside by the application of cold poultices; and the cicatrization of the wound prevents their return.

Prolapsus ani, as I have already said, is frequently the result of external piles, and the removal of the latter almost invariably cures that tendency. I am inclined to believe, that excision of a portion of the circumference of the anus would prove a more certain means of radical cure of prolapsed rectum than the operation usually had recourse to, viz., removal of portions of the mucous membrane of that intestine by means of ligatures or excision.

Morbid excrescences, termed *condylomatous growths*, are frequently formed about the verge of the anus; these may be mistaken for external piles, but are generally produced by the irritation caused by the discharge in protracted gonorrhœa: they rarely require excision, as the "yellow wash" may almost be considered as a specific for the disease. Another description of warty excrescence follows syphilitic affections, but it may be distinguished from that in gonorrhœa, as they resemble rather warty granulations, and are attended by considerable discharge and pain, and can only be cured by the internal administration of mercury: they are generally attended by sore throat, cutaneous eruption, or some other symptoms which mark their syphilitic character. A question may arise as to the source of these warty excrescences: they certainly must be considered as primary symptoms of syphilis, and can therefore only be generated by inoculation, to which there must be some considerable liability, from the frequent existence of excoriation about the anus, and the proximity of the originally affected parts.

Fissure of the rectum.—I have rarely met with this disease in hospital practice, but have found it not unfrequently in the higher classes of society, particularly among females; and it may, perhaps, depend upon luxurious habits of living, want of sufficient bodily exercise, and from inattention to the state of the bowels, as constipation is usually concomitant with the complaint. Protracted constipation tends to induce a state of contraction, and consequent resistance of the sphincter muscle; so that, the fæces being retained within the rectum, the mucous membrane of the bowel becomes inflamed; and a liability to ulceration and fissure is no doubt the frequent consequence. The existence of fissure is indicated by an excruciating pain in the rectum, which is felt for an hour or two after defæcation. The remarkable acuteness of this pain forms the principal diagnostic mark of the disease; for in prolapsus and fistula in ano, the character of the pain is rather aching than acute. The pain in fissure is sharp and stinging, and generally confined to one part of the bowel, usually its posterior surface towards the os coccygis. The description of this kind of pain would lead the surgeon at once to make an examination per anum, when the excessive pain experienced on passing the finger through the sphincter would constitute an additional diagnostic sign of the nature of the complaint. When the finger is introduced,—and from the irritability of the muscle this can only be effected with some difficulty,—a ragged depression will be distinguishable in the mucous membrane; an accurate appreciation of the length and depth of the fissure will thus be obtained, and, when the finger is withdrawn, a stain of blood is perceivable on it, which indicates, in some measure, the form and extent of the ulcer. This disease may be cured by the following means:—A straight probe-pointed bistoury should be passed along the finger through the anus, so as to divide, in a longitudinal direction, not only the ulcerated mucous membrane, but also the subjacent muscular fibres of the sphincter, which prevent the healing of the ulcer by their frequent contractions. The knife must not be employed too freely, as there would be danger of cutting through the bowel; but here, as I have before often remarked, the degree of force that may be safely employed can only be learned by practical experience. During the operation, the patient must be placed in the prone position, with his feet resting on the ground, and his body lying across the bed: the ulcer will then be found on the upper or coccygeal surface of the bowel, and is conveniently placed for making the incision. Nitrate of silver, or lotions of any kind, are unavailing in this disease; but in almost every case the operation affords a certain means for its cure. It is true that the operation removes only the effect, the cause still remaining; but this also may generally be overcome by a strict system of diet, and the employment of such constitutional remedies as the peculiarities of the case indicate. A very similar fissure to that of the rectum often occurs in the centre of the lower lip. This sometimes resists all local applications, but I have cured it upon the principle just described; that is to say, by dividing the fibres of the orbicular muscle immediately below the fissure, the consequence being that an ulcer which had remained unhealed for several months was completely cured in the course of a very few days.

LECTURE XLIII.

CONTINUATION OF DISEASES OF THE RECTUM.

Rectum—Fistula in ano—Premonitory symptoms—Preparation of the patient before operation—Case—Mode of operating—Constitutional means to prevent the return of the disease—Recto-vaginal fistula—Cases—Recto-vesical fistula—Lacerations of the rectum—Mode of promoting the cure—Stricture of the rectum—Liability to stricture in all excretory outlets—Spasmodic stricture—Permanent stricture—Symptoms—Treatment.

I SHALL commence this lecture with an account of the disease termed *fistula.* This disease is usually first manifested externally by the presence of an abscess, or slight swelling, or hardness at the side of the anus. This is not, however, the true commencement of the complaint, which I believe generally begins in the bowel itself, above the sphincter muscle. The persons most liable to this disease are those who lead sedentary lives, and are irregular in their diet: such persons easily acquire a congested state of the liver, or affection of the lungs, and the rectum very soon becomes affected in consequence.

The first symptom of fistula is a deep-seated pain and sensation of uneasiness about the anus, continuing for an hour or two after evacuation of the bowels, and sometimes attended by a slight discharge of blood. I have also known slight rigor to be a precursor of fistula. When a patient describes the symptoms just detailed, we should at once proceed to examine the region of the anus, and although there may be nothing abnormal appreciable by the eye, if the finger be forcibly pressed between the tuberosity of the ischium and the verge of the anus, an unnatural hardness will frequently be felt, and considerable pain produced by the pressure. If these symptoms present themselves, a lancet should be plunged into the swelling, upon which a small quantity of matter generally escapes, or perhaps the lancet will be merely stained by it; this would, however, be sufficient to prove satisfactorily that suppuration has been the cause of the symptoms.

These indications are supposed to mark the commencement of fistula in ano; but, as I have already said, the disease itself no doubt commences in the rectum as an ulcer, immediately above the sphincter ani, the original cause probably being the retention of the fæces, which excites ulceration through all the tissues of the parietes of the rectum, extending into the cellular tissue, where it produces those external signs which are generally regarded as the commencement, instead of the consequence, of the disease. If at this stage the fistula be neglected, it extends by the side of the rectum, isolating a large portion of the bowel from its cellular connexion, and, ultimately bursting through the skin by the side of the anus, converts that which was at first termed a blind, into an open fistula: sometimes the ulcerated opening is formed at a considerable distance from the anus, or three or four fistulous openings may be established by the burrowing of the matter. It does not invariably follow, however evident it may be that nothing but an operation can cure a fistula, that that operation is to be at once performed, although it is advisable to ascertain immediately the extent of the fistula; if irregularity of the bowels, enlarged liver, and a jaundiced complexion, indicate a cachectic habit, medicinal treatment must be employed to renovate the health before it would be safe to venture upon the operation; the remedies which I have generally found most effective for this purpose, are small repeated doses of mercury and sarsaparilla, quinine, or other tonic medicines. Not many months ago, I had a strong illustration of the danger of operating in fistula without being previously made acquainted with the peculiar habits of life of the patient. An artist, who resided at Chelsea, was brought to me by his usual medical attendant. I examined the patient, ascertained the extent of the local disease, and at once told him that a cure could only be effected by operation. I inquired as to his usual health, and was informed that it was good—his appearance also seemed to corroborate this statement: I therefore merely ordered a slight aperient, and four days after performed the operation at his own house. The fistula was not very extensive, and the operation in every way less severe than usual; but, directly after, the patient betrayed so much irritability, that I ordered him to take thirty drops of laudanum, and an ounce and a half of camphor mixture: the next morning I found that he had had no sleep, and although not complaining of pain he was in a very restless state, and his manner was indicative of extreme anxiety: no secondary bleeding had occurred, and the wound appeared perfectly healthy. I ordered a grain and a half of calomel and a grain of opium to be taken directly, also the following mixture:—

℞ Træ. Hyoscy. ʒij.
Liqr. Ammon. acet. ℥jss.
Julep. Ammon. ℥vjss. M.
Capt. cochl. larga ij. quaque quart. hora.

The next day he was in much the same state; he had never closed his eyes the whole night; he had been delirious, and during my visit was in the condition of one in great mental alarm, and symptoms of delirium tremens were beginning to manifest themselves. I now inquired of his wife whether his habits were intemperate, and after some hesitation she informed me that he frequently drank as much as a bottle of brandy in a day, commencing at an early hour in the morning. He remained in the state I have described for five days, at the end of which he died. This case affords abundant instruction: it shows the necessity for scrupulously investigating the condition of the health of the patient, and also his general habits of living, before we proceed to perform any operation; for had I been acquainted with the intemperance of the individual in the case just quoted, I should never have dreamt of operating on him, until I had taken measures to improve the tone of his health by the administration of constitutional remedies, restricting him at the same time in the use of ardent spirits.

Operation for fistula in ano.—The success of this operation depends entirely upon the complete division of the sphincter ani muscle, for by its contractions it offers resistance to the free passage of the contents of the bowel, which then have a tendency to pass through the abnormal opening, and keep up its fistulous character. If a probe be introduced into the opening through the skin, it can generally be passed two or three inches upwards by the side of the rectum, and if, at the same time, the finger be placed in the bowel, the point of the probe can be readily felt through the parietes. I believe, however, that the communication is rarely formed between the bowel and the fistula so far above the sphincter; no advantage is therefore derived from this extensive exploration, and it is, in my opinion, very bad practice to make an incision in the bowel so high up; for if a very extensive wound be unnecessarily made, large vessels are exposed to danger, and nature is called upon to repair a greater lesion than is really requisite. The operation should consist in merely introducing the probe into the external opening, and in seeking, by gentle manipulation, for the point of ulceration into the bowel itself: this will usually be found immediately above the upper edge of the sphincter muscle; if there should be any difficulty in discovering it, the probe-pointed bistoury may be gently forced through the parietes of the rectum, and the point of the knife being in contact with the finger, which has been already passed up the anus, the division of the sphincter may be effected by drawing both hands simultaneously downwards, still keeping the finger and point of the instrument in firm contact. This operation removes the obstruction the sphincter muscle offered to the free passage of the fæces, which were consequently forced into the fistulous openings; but when the muscle has been divided by the operation the sinuses readily heal, and in a short time the disease is completely removed. To secure the granulation of the wound, and prevent the mere adhesion of its cutaneous surface, the whole of the divided part should be filled with lint, and the bowels kept in a state of constipation for some days, so that there may be no interference with the reparative action. When aperients are administered, the patient should be made aware that he will have no power to restrain the evacuation of the fæces: this must, of course, be the result of the division of the sphincter ani. In cases of neglected fistula in ano, the sinuses sometimes open at a considerable distance from the verge of the anus; so that, if the operation be performed precisely according to the above description, a very extensive incision would have to be made through the gluteal region, to comprehend the whole length of the sinus. To avoid this, the operation may be modified as follows:—A probe is to be passed along the fistula into the bowel, and then bent by the finger in the rectum so as to bring the point out at the anus; the two ends should be drawn downwards to bring the sinus towards the surface; the probe is then to be cut down upon, just as it is entering the intestine above the sphincter, and, the probe-pointed bistoury being directed along the probe into the bowel, the probe may be withdrawn, and the bistoury made to divide the sphincter as already described. By this manner of proceeding two-thirds of the length of the fistula may remain undivided, and will readily heal, as there is no longer any obstruction to the passage of the fæces per anum. There is still another modification of the operation, which it may sometimes be advisable to adopt in certain cases of fistula, and I have myself had recourse to it. If on passing the finger into the bowel, for the purpose of examining the situation of the ulcerated opening, it be discovered that the hæmorrhoidal vessels are abnormally enlarged, which would be indicated by the strength of their pulsation, a ligature may be employed, instead of a knife, for the purpose of dividing the sinus and sphincter ani. To perform this operation an eyed probe (furnished with a strong silk) is passed through the sinus, into the bowel, one end of the silk being brought out of the anus, and the other left hanging from the orifice through which the probe had entered. The probe should then be withdrawn, and the two ends of the silk tied tightly so as to compress all the intervening structures: the ligature requires to be tightened daily, for the constriction becomes lessened as the ulceration advances. In the cases in which I have performed this operation, I was surprised to find that the patients complained of even less suffering than in the usual operation, that the wound healed as readily, and did not require to be filled with lint, as, of course, there could be no tendency to unite by adhesion. I may also mention, that the hæmorrhage which sometimes follows the division of a fistula by incision is not only most alarming, but occasionally proves fatal; and therefore, in cases where there are indications that a larger quantity of blood than usual is sent to the part, it is highly important to avoid incising the vessels; and this may be done by substituting the ligature for the operation by the knife.

The term fistula in itself merely expresses the sinuous form of the abscess; but it is in consequence of its specific character that the surgical operation affords the only means of permanent relief; for, being lined with an adventitious mucous membrane, it becomes converted into a supernumerary excretory outlet, which would remain permanent as long as any communication with the rectum continued; and therefore it is that it demands the operation I have described. A patient who has once been the subject of this disease is very liable to its recurrence; and every means should be employed to prevent any source of irritation from acting upon the cicatrix; for, should that give way, it would be found extremely difficult to reunite it, and the failure would lead to the establishment of a loathsome condition, produced by the existence of a passage for the fæces by the side of the anus.

A fistulous opening from the rectum may possibly communicate with the bladder, or with the vagina, giving rise to the most distressing consequences, and such a state frequently occurs after difficult parturition. I knew a case in which a lady was the subject of this lesion; and, after many vain attempts had been made to sew up the fistulous openings of the rectum and vagina, and other plastic operations had been ineffectually resorted to, Mr. Copeland restored the patient to health by merely dividing the sphincter ani, which not only prevented retention of the fæces within the rectum, but, at the same time, precluded the necessity for the action of the levator ani muscle. The contents of the rectum, no longer meeting, therefore, with any obstruction to their passage from the anus, had no tendency to pass into the vagina, the fissure in which immediately healed. A lady was lately under my care, who was the subject of a fistulous opening from the rectum into the vulva, through which the fæces in part escaped. On examining the case, I passed a probe from the vulva into the rectum, and found both openings so near to the outlets of the rectum and vagina, that, by passing in a bistoury and dividing the perineum, I should completely lay open the whole length of the fistula and the sphincter ani at the same time. I was at the moment much disposed to try this operation, as it seemed to afford the readiest and simplest mode of cure; still, I had some misgiving as to the certainty of effecting the ultimate filling up of the wound; and I consulted Mr. Copeland on the subject. He recommended me by no means to adopt the plan I had thought of, as he had known it tried upon three or four occasions, and in none of them did the patients ever recover the power of retaining the fæces; so that they were in a much worse condition from the operation than from the original disease. The operation I ultimately adopted, therefore, was, to divide the fibres of the sphincter ani muscle, and pass a probe covered with potassa fusa through the sinus, so as perfectly to destroy the mucous surface of the fistula. As the granulations thus produced did not seem to fill up the opening, I brought the surfaces of the fistula in contact by means of a ligature, which came away in a few days, and the opening into the vulva was much diminished; but still the communication between the two organs was not obliterated. I then daily applied the tincture of lytta to the granulating surfaces, and the lady left London, although it could not be said perfectly cured, with the prospect of the granulations becoming ultimately converted into permanent tissue.

These cases, as well as those of lesions between the bladder and vagina, are most difficult to cure; and I believe that, unless the division of the sphincter ani promotes their obliteration, although other means may be somewhat accessory, they are never sufficient to produce a cure. My colleague, Dr. Lever, has had several cases of recto-vaginal and vesico-vaginal fistulæ, which he has attempted to obliterate by plastic operations, and by sutures, caustic, and actual cautery: the result of his experience proves, however, that very few cases are ever permanently cured, although, by means of actual cautery, he has frequently reduced the abnormal openings to the size of a pin's head; but I believe that only in one or two cases has he succeeded in producing a permanent cure.

Laceration of the rectum sometimes occurs from external injury, and is probably most frequently produced during the extraction of a stone from the bladder in the operation of lithotomy; but it is remarkable that these lacerations do not seem to offer the same difficulty in reparation as that which results from internal causes, although I have known one case in which a fistulous opening between the rectum and perineum remained permanent. The division of the sphincter ani in such cases affords the best prospect of cure. I have admitted patients into Guy's Hospital with laceration of the rectum occurring from a fall on a sharp-pointed body, such as a paling; and in two instances I have known the same kind of injury produced by the goring of an ox. Under these circumstances, the treatment consists in keeping the bowels moderately open, and the rectum completely cleansed from all fæcal matter after each evacuation; this must of course be done by means of injections. Should the lesion in the rectum remain obstinately unhealed, in consequence of the sphincter ani still retaining some contractile power from its fibres having been but incompletely divided, the entire division of the latter should be performed; and this, unless some very untoward circumstances occur, is almost certain to produce a cure.

Stricture of the rectum.—All excreting outlets are furnished with a lining of mucous membrane, and appear to be susceptible to obstruction in consequence of abnormal contraction in the size of their canals, owing to the deposition of adhesive matter in the submucous cellular tissue. This liability to become obstructed from an adventitious deposit seems universal in these outlets, from the puncta lachrymalia to the rectum itself. The œsophagus, especially in hysterical females, is subject to a difficulty in propelling the food, simulating in many respects the symptoms of stricture, but depending in reality upon temporary spasmodic action, which can be readily relieved by the use of narcotics and tonics. The rectum is, I believe, sometimes subject to the same kind of affection, which may also be relieved by the employment of similar anti-spasmodic remedies. Permanent obstruction in the rectum is, however, of frequent occurrence. A strong symptom of this is constipation, which is produced partly by the influence of the physical obstruction to the passage of the fæces, and partly by the voluntary suppression of them by the patient, from the dread of the acute pain so frequently experienced in the act of defæcation. The egesta in stricture of the rectum are passed in small rounded portions, or if "figured," of very small diameter, from being forced through the contracted part: the patient usually complains of distention of the abdomen, interference with the function of respiration, and loss of appetite. With these symptoms an examination should be made per anum, at first with the finger alone, and this will probably lead to the detection of the obstruction, which is often very firm, and resists the entrance of the finger into the bowel. This excessive hardness may be produced either by scirrhus or by a mere attack of inflammation, and the hardness alone is not to determine the judgment of the surgeon as to the disease being malignant, as that question will be best decided by the age of the patient, the length of time the disease has existed, and by the nature of the pain. If, for instance, the patient be old, the pain constant, severe, and of a lancinating character, and he has great dread of exciting the muscular action necessary to the evacuation of the bowels, and if at the same time there is an appearance of what is termed malignant diathesis, the prognosis would be unfavourable. But, if the obstruction results from simple inflammation in a youthful patient, it will be indicated by the suddenness of its appearance, by the febrile symptoms attendant upon it, and by the peculiar sensation conveyed to the finger; for although there is considerable hardness, it is not of the stony character that marks scirrhus, but gives the idea of its being a dense projection of the natural structures into the bowel, rather than an adventitious deposit. When the disease is malignant, bleeding is frequent, particularly upon examination either by the finger or instrument, and the pain lasts for a considerable time after, which is not the case with common stricture. The treatment in the non-malignant disease consists in the occasional application of leeches around the anus, the patient being kept in the recumbent posture; and I believe that enemata will be generally found better than bougies, as the mechanical means of overcoming the obstruction; unless they act too much upon the bowels, in which case bougies must of course be employed.

The introduction of a bougie is an operation requiring considerable knowledge of the parts, and a competent acquaintance with the change of the relative situation of the rectum consequent upon the position in which the patient is placed. From want of this knowledge, unskilful practitioners often do great mischief, sometimes wounding the rectum, producing extravasation of fæces, peritonitis and death. The bougie should, therefore, only be employed by the scientific surgeon. Leeches, the recumbent posture, injections, and, in some cases, the use of the bougie, and cupping in the loins when the pain is severe, are the means to be had recourse to in non-malignant obstruction. And often by such measures, a disease which at first appeared to be of an alarming character, is quickly removed. In malignant disease but little can be done: the adventitious matter indefinitely increases, so as at length completely to obliterate the bowel, and the patient dies from the insuperable barrier opposed to the escape of the excretions, unless an artificial anus be made in the colon; or, as some surgeons have recommended, a cutting gorget, or some instrument of the kind, be forced through the obstruction; but this, if it afford any relief, can only do so temporarily. Scirrhous stricture generally destroys the patient by the propagation of the malignant disease through the medium of the absorbents to some distant part: thus, perhaps, transplanting it to important vital organs; in which case, the re-action on the constitutional powers is very rapid, and the patient soon sinks under its influence.

Polypi sometimes spring from the surface of the mucous membrane of the rectum, in the same manner as from other mucous surfaces. They generally appear in children, and are seen to project from the anus after stool, under the form of a reddish soft tumour, rather granular on its surface. The treatment of these polypi is very easy and effectual: they must be included within a ligature, and then returned into the bowel, where they soon slough off without giving much pain or inconvenience; they should never be excised, as they are sometimes very vascular, and may give rise to a dangerous hæmorrhage.

In the examinations and operations on the rectum, chloroform is often very useful, as it diminishes the irritability of the parts; but as the operations in this part are so quickly performed, it may be thought unnecessary to employ chloroform, as this agent may produce more constitutional disturbance than would arise from the operation itself. As to the speculum, I seldom employ it myself, as in all ordinary cases of disease of the rectum, I think the finger of an experienced surgeon gives a very accurate account of the condition of the parts; at the same time there are undoubtedly cases in which the speculum is very useful, and in which, indeed, it would be difficult to dispense with its use.

LECTURE XLIV.

GENITO-URINARY ORGANS.

Their anatomical relations—Urethra—Its conformation—Natural dilatations and contractions—Lacunæ—Stricture of the urethra—Often constitutional—Treatment—Gonorrhœa a frequent cause of stricture—Diagnosis—Treatment—Mixed stricture—Treatment—Gentle use of bougie—Permanent stricture—Bulb of the urethra most liable to stricture—Does not occur in membranous part—Difficulty in passing urine—Neglect of patients in seeking medical advice—The probable consequences of delay—Symptoms of stricture—Examination by the bougie—Retention of urine—Means of overcoming the obstruction—Dilatation by the bougie—By the injection of water—Application of caustic—Introduction of catheter—Use of cutting instruments—Puncturing the bladder, per rectum, above the pubes—Case—Cutting through the perineum—Case—Obstructions in the urethra from calculi—Mode of removal—Cases.

Diseases of the genito-urinary organs.—The most common of all the diseases to which these organs are liable is stricture of the urethra. The urethra can scarcely, however, be considered as a genital organ with reference to stricture, since, in case of its obstruction, the symptoms relate only to its function as an apparatus of micturition. At the same time the procreative power is sometimes to a certain extent interfered with, and therefore I have thought it proper to treat of stricture of the urethra under the above heading.

The genito-urinary organs are placed partly within the abdomen, and partly external to it; thus the prostate gland, the vesiculæ seminales, portions of the vasa deferentia, and of the urethra and the bladder, are internal to the abdominal cavity, while the remainder of the urethra and the testicles are external. Our attention is now, however, to be directed to the urethra, which has to perform the double function of micturition and procreation. As a micturating organ, the urethra is passive, but as one of generation it is endowed with great excitability; and it is when in a state of excitement that it is chiefly susceptible to the influences that induce obstruction and disease in it, although when thus affected the symptoms relate entirely to the difficulty in passing the urine.

You are doubtless aware, gentlemen, that the calibre of the canal of the urethra is not equal throughout its whole extent; it has, indeed, three points of contraction, and three of dilatation. This peculiar conformation of the urethra should always be remembered in introducing the catheter or bougie, otherwise the slight obstruction offered to the entrance of the instrument by the natural contraction in the canal, may be mistaken for an abnormal condition. The first contraction of the canal is found at its entrance, in the glans, and this contraction sometimes produces a difficulty in the very first step in the operation for lithotomy and lithotrity, as the meatus may be so small as to prevent the entrance of a sufficiently large instrument; this is, however, a difficulty that can easily be removed by enlarging the meatus with a probe-pointed bistoury, when, as the contraction usually exists merely at the urethral orifice, the instrument may be readily introduced. The second contraction is situated at the membranous part of the urethra; and at this point there is always some little difficulty in passing a catheter, not only from the natural diminution in the size of the canal, but also on account of the curved direction which the urethra takes in its passage through the deep fascia of the perineum: this curve can, however, be overcome, by slightly stretching the penis, and holding it at an angle of about 45° while the catheter is being passed. The third contraction is within the prostate gland, just behind the veru montanum; this offers, however, no impediment to the passage of an instrument. With respect to the dilatations alternate with the contractions, I do not know of any very important points. The first of these dilatations is situated just within the glans penis, and is termed the fossa navicularis; the second in the bulb, and the third within the prostate gland; in the latter, the vasa deferentia and ducts of the vesiculæ seminales terminate. Within the urethra there are also small valvular openings termed lacunæ; they are placed upon the upper surface of the canal, and are for the purpose of secreting a fluid for its lubrication. The largest of these openings is placed about an inch and a half below the meatus; it is termed the lacuna magna, and is the principal seat of gonorrhœa. The surgeon should pay particular attention to the position of this opening, as in passing small bougies they often become entangled in it, so as to induce the belief that a stricture exists, whereas the obstruction arises only from the natural formation of the part, the free edge of the valve being directed forwards towards the opening of the urethra.

Stricture of the urethra.—Stricture of the urethra consists in an abnormal contraction in any part of the canal: this contraction is caused by a morbid deposition of adhesive matter in the submucous cellular tissue; or by a sudden congestion in the corpus spongiosum. In the first case, the stricture is permanent, in the latter it is merely temporary.

Strictures have been divided into two classes, permanent and spasmodic. Some authors have added a third class, which they have termed "mixed stricture." I believe that the doctrine of spasmodic stricture has been founded upon the supposition that the urethra is, throughout the whole of its length, partially composed of muscular fibres: of this there does not, however, appear to be any proof. Mr. Howship considered that the existence of muscular fibre in the urethra is proved by the power which it possesses to expel spontaneously a moderately-sized bougie. This action he attributed to muscle, but it may result from the excitement produced in the erectile tissue of the urethra, the consequence being an increased flow of blood to the part, which causes a contraction in the calibre of the urethra: the expulsion of the bougie is the effect of this contraction. In the same manner, spasmodic stricture is produced, when, from some morbid cause, a sudden distention of the erectile tissue occurs. The idea that these obstructions are true muscular spasmodic contractions has probably been strengthened by the circumstance that they are relieved by precisely the same remedies as those that overcome muscular irritability—viz. bleeding, purging, nauseating medicines, and hot bath,—a treatment which exercises, in fact, an equal influence over the circulating and muscular systems. When the contractions occur, however, in the bulb or membranous portion of the urethra, muscular fibre may be secondarily affected as both those parts are under the influence of muscle, although muscular fibre does not enter into the composition of the urethra itself.

The kind of obstruction generally termed spasmodic stricture, independent of muscular action, may perhaps be with more propriety called "irritable stricture,"—an affection frequently induced merely by general irritability of the constitution. This kind of stricture requires, as I shall presently show, to be treated by sedatives administered to the system generally, and by soothing local applications; such strictures may, however, result from disease in the neighbouring organs—as the prostate gland, bladder, or rectum; although it is much more generally the effect of some morbid action commencing in the urethra itself; and perhaps gonorrhœal inflammation is one of the most frequent of its causes.

Any circumstance that produces irritation, and consequently an extraordinary influx of blood to the corpus spongiosum, will have a tendency to diminish for the time the size of the urethra. This is the case during the natural excitement of the organ; as when it is in a state of priapism the urine can scarcely be expelled even in minute quantity. A partial determination of blood to the part produces, therefore, a certain amount of obstruction, and constitutes what I consider spasmodic or irritable stricture. This condition may be distinguished from permanent stricture by the suddenness of the attack, unattended by any premonitory symptoms besides those which cause the irritability—such as protracted retention of the urine, hæmorrhoids, or excessive venereal excitement. In the treatment of this affection, the catheter should not be employed at first, but a dose of opium with tartarized antimony given, and these should be followed by the hot bath and a warm purgative enema; such treatment will generally be found sufficient to remove the complaint without having recourse to the use of any instrument. If the catheter be passed without the sedatives being first employed, even should it effect its intended object, viz. relief of the retention of urine, it would tend to increase the cause of the obstruction by irritating the urethra; it would also probably cause considerable bleeding, and perhaps lacerate the canal itself. I do not, however, mean to say that constitutional remedies alone will always remove the disease; for the congestion of the vessels of the irritated part, or perhaps some subcutaneous effusion, may lead to permanent obstruction; and if that were the case, and local irritation present at the same time, the mixed kind of stricture already alluded to would be established. In obstinate cases of this mixed stricture, cupping in the perineum will often be found of great advantage: two grains of calomel and a grain of opium may be taken at bedtime, and also small doses of the sesquichloride of iron, and the bougie may at the same time be employed in a very gentle manner; but if it should produce pain and bleeding, caustic should be applied to the stricture; and this I believe is almost an infallible means of subduing the irritability: the following suppository at bedtime will also be found to produce a very beneficial effect:—

℞ Pulv. Opii, gr. iss.
Ext. Hyos. gr. v.
Sapon. Hispan. q. s.
Ft. suppositorium.

But ordering the suppository is, however, not sufficient; the surgeon should himself introduce it into the rectum, otherwise it may increase, instead of diminish, the sufferings of the patient. If, for example, it be only placed within the anus, under the influence of the sphincter muscle, it will produce an aggravation of all the symptoms; while if it be passed into the bowel above the sphincter, it will speedily produce the desired soothing effect. After the symptoms of irritation are relieved, there may still remain slight permanent obstruction, requiring the continued use either of the catheter or bougie to re-establish the natural calibre of the urethra: the size of the instrument may be fairly judged of by that of the stream of water passed in micturition; but whatever the instrument may be, *gentleness* in its use is the great point to which attention should be directed.

Permanent stricture.—The kind of stricture termed permanent consists in a contraction of some part of the urethral canal from the formation of an adventitious deposit. It does not exist in the urethra itself, but in the cellular tissue between the mucous membrane and corpus spongiosum, the mucous membrane being pressed inwards so as to reduce the size of the canal at the point at which the deposit is produced. This deposition of matter, and consequent morbid contraction of the urethra, may result from various causes, which, either in an acute or chronic form, may give rise to the stricture. Protracted gonorrhœa is, as I have already stated, the most frequent cause; but external injury, an acrid state of the urine, or anything that can produce an irritable stricture, may also be the means of establishing a permanent one. The bulb of the urethra is the part most liable to stricture, as it is not only the most vascular, but composed also of a large quantity of cellular tissue: it likewise, from the close vicinity of the ducts of Cowper's glands, is very subject to become implicated in the diseases that attack them. Some surgeons state that the membranous part of the urethra is often the seat of stricture; but such is not the case; and anatomically, it will be readily seen why it should not be so, owing to the small quantity of cellular tissue which surrounds it, and the absence of corpus spongiosum: it may, however, be subject to temporary constriction, from the contraction of Wilson's muscles, which completely encompass it.

The result of stricture is necessarily a difficulty in passing the urine; and, therefore, increased muscular action is required in the bladder and abdominal parietes to force the fluid through the contracted urethra. The violence with which the urine is propelled against the stricture tends to excite further irritation: the obstruction consequently becomes increased; and if, at the same time, the subject of the disease pays no attention to dietetic rules, and exposes himself to vicissitudes of temperature, the difficulty of micturition increases, and every symptom is aggravated: still, it is surprising to remark to what an extent patients will allow the disease to proceed before they consult a surgeon. Nothing can be more unwise than such procrastination; for during the delay the bladder becomes thickened, its capacity correspondingly reduced, the ureters enlarged, the pelvis of the kidney distended, its secreting portion compressed, and the secretion of urine diminished,—all which effects are more or less the consequence of not early seeking medical advice; the result being, that in addition to these symptoms of the disease itself, the general health of the patient is likely to become seriously affected. The delay on the part of individuals suffering from this complaint, can only be accounted for by the insidious manner in which the symptoms follow each other; and I have known persons submit so long to the difficulty in passing the urine, that the urethra has at length given way behind the stricture, and extravasation of urine into the perineum had occurred before any medical assistance had been sought.

The first complaint of a patient in this disease is generally, that he experiences a difficulty in passing his water, which act requires a much longer time than is natural; and after he believes that the bladder is emptied, the desire for further evacuation immediately returns, and an additional portion, equal in quantity to the first, is voided, the stream in which it escapes from the urethra being remarkably small and tortuous. The frequent inclination to make water is almost invariably an early symptom of stricture, and sometimes an involuntary dribbling comes on, which causes great inconvenience and annoyance. These symptoms vary very much in degree, and are increased by any kind of intemperance, and by exposure to wet and cold: abstinence and quietude are, however, sure to afford relief. It is this fluctuating character, and the occasional cessation of the symptoms, that probably induce the patient to defer so long any application for medical assistance. When consulted under such circumstances, the first step will be to make an examination of the urethra, by passing a bougie; this is generally done while the patient is standing with his back against a wall, but I think this a bad plan, for patients are very liable to faint upon the introduction of the instrument, even although they do not experience pain. I therefore consider it better that the individual should be placed in the recumbent posture on a sofa.

The patient being placed in the proper position, a bougie or silver catheter (No. 6) is well oiled, and, raising the penis to an angle of about 40° from the abdomen, the instrument is passed gently down to the stricture, against which it is slightly and equably pressed for the space of a minute, or perhaps rather more, according to the degree of pain the patient experiences. It may happen that the instrument soon passes the obstruction; if that be the case I do not advocate its further introduction, so that it may enter the bladder, but think it better to be satisfied with the progress already made. After the employment of the bougie, the patient should be kept extremely quiet during the remainder of the day, should live abstemiously, and at bedtime take the following draught:—

℞ Liq. potass gtts. xx.
Træ. opii, gtts. x.
Mist. Camphoræ, ℥iss.
Ft. haustus.

An aperient should likewise be taken the next morning. The instrument should be again passed about forty-eight hours after the first examination, and it may now be passed into the bladder and left there for ten minutes or a quarter of an hour, unless it causes great irritation, for I have always found the cure to be greatly expedited by the continued pressure which the instrument keeps up. I have recommended No. 6 as the size of the instrument first employed; it is less likely to produce irritation than one of smaller size; for the latter is not only likely to catch in the lacunæ, but may also make a false passage by penetrating the sides of the urethra. If, however, No. 6 be found too large to pass through the stricture, smaller instruments must necessarily be used; but it should be borne in mind that they require a degree of caution in their introduction proportionate to the smallness of their size. If the instrument cannot be passed though the stricture into the bladder, a question naturally arises as to what other means are to be adopted for the relief of the patient. This depends entirely upon the urgency of the symptoms, especially in reference to the distention of the bladder from the retained urine: the judgment cannot here be much guided by the expressions of the patient as to the amount of his suffering, for the pain which in one patient may be described as little more than inconvenience, may be complained of by another as excruciating agony. Therefore, the first thing to be done is to examine the state of the bladder per anum, and also through the parietes of the abdomen. If the bladder be felt pressing on the rectum, you may be assured that the distention is extreme, for it is in the posterior direction that the organ projects lastly under the influence of the internal pressure of the urine. I have but very rarely met with a case that did not admit of sufficient delay to allow of the trial of medicinal means before proceeding to puncture the bladder, although no doubt such cases occur. The plan I adopt is to place the patient in a hot bath, give a large dose of opium (gr. iss. to gr. ij.) and employ a purgative enema. As soon as the bowels are open I order a suppository, composed of opium and a fourth of a grain of belladonna, to be inserted into the rectum: this treatment rarely fails to produce a flow of urine, which, even if it takes place but slowly, relieves the urgency of the symptoms, and gives time for the adoption of further means for the removal of the obstruction. This may be effected by four different methods—dilatation, caustic, puncture, and incision.

Dilatation should always be first tried; it is effected by the catheter, bougie, or by injecting the urethra with water. In speaking, however, of this treatment of stricture, I wish to impress on the mind of the student that something more is to be done beyond the mere mechanical removal of the impediment to the passage of the urine, and that the use of local remedies should be judiciously combined with constitutional; the latter consisting chiefly in the strict observance of dietetic rules, the state of the bowels, and in the employment of medicines which tend to diminish arterial action; such as blue pill, with tartarized antimony, and slight aperients. Recent stricture may almost always be cured by this system of treatment, aided by the gentle introduction of the bougie every other day; and even when the stricture has reached a more permanent form, its cure may generally be effected by following out this plan, and in passing the instruments without violence, as the object is not to force a passage through the stricture, but by gentle pressure to produce a slight inflammatory action, in consequence of which, disintegration and absorption may be induced. This plan was strongly recommended by Dupuytren, and I have followed it with great success. The appearance of a slight purulent discharge indicates that the treatment is producing the desired effect upon the stricture, and soon after this effect is first seen, the catheter will generally pass the obstruction. During the progress of the treatment a permanent stricture often becomes irritable, — just as irritable stricture is convertible into permanent: this change is shown by a tendency to bleed on attempting to pass a catheter, and by the pain which the slightest touch of the instrument produces; in such cases it will also be found that if the catheter be passed there will be considerable difficulty in withdrawing it, and this will generally be attended by bleeding. With these symptoms recourse must be had to sedatives, and to the caustic bougie, which seldom fails to diminish the irritability, probably by destroying the sentient extremities of the nerves which had become exposed by the ulcerative changes in the substance of the stricture. Some surgeons recommend the use of potassa fusa as the escharotic, instead of nitrate of silver. I believe it unsafe, however, on account of its deliquescence, which renders it much less manageable. In cases in which the stricture resists the gentle application of bougies, I have rendered the obstruction permeable by injecting tepid water into the urethra by means of a syringe furnished with a long canula. By repeating this operation the opening soon becomes dilated,—a condition soon made evident by the greater freedom with which the water enters: a bougie may afterwards again be had recourse to. It is somewhat remarkable, that after the introduction of the bougie, although no evident mechanical effect has been produced by it, the patient finds that he can pass his water much more freely, and yet perhaps the instrument may not penetrate the stricture until some days after. Caustic is sometimes employed as a direct means of overcoming a stricture when its density is so great as to prevent its being acted on by simple pressure. The application of the escharotic produces a slight slough on the surface, and tends to soften the mass of adventitious matter, so as to render it better fitted for absorption. Some precaution is necessary in using the caustic bougie, and contact with any portion of the urethra besides the stricture must be carefully avoided. To secure this, a larger instrument should be passed first, to clear the way, as it were, for the cauterizing bougie.

Although I have attached great importance to the observance of extreme gentleness in the introduction of the catheter, circumstances may occur in which it may be necessary to employ force to effect its entrance into the bladder; for it may happen that the symptoms of retention of urine may be so urgent, that immediate relief is imperatively necessary. Under such circumstances, the forcible introduction of the catheter becomes not only a justifiable but an advisable measure.

If, in the attempt to introduce the instrument, it is found that it can be brought to a right angle with the body in its recumbent position, it will prove that the stricture is situated just at the junction of the bulb with the membranous part of the urethra, and then, in order to effect the introduction of the catheter into the bladder, the fore-finger of the left hand should be passed into the rectum; and when the point of the instrument is felt, as it may easily be, the handle must be depressed with moderate force, and the point directed at once into the bladder. Some surgeons recommend that in such strictures the catheter should be thrust in with sufficient force to overcome the obstruction at all risks; but I am persuaded that this is bad practice, as the laceration of the canal, perforation of the prostate gland or rectum, are accidents very likely to occur: it is, therefore, better to puncture the bladder than to have recourse to such violence.

In cases where the catheter cannot be passed through the stricture, instruments have been employed for the purpose of cutting a passage: the instrument is composed of a kind of catheter with a concealed lancet, which can be projected from its canula when it touches the stricture. But it is so perfectly impossible to direct a sharp-cutting instrument merely through the obstruction without wounding the urethra itself, that I totally repudiate its employment, unless it be for the purpose of dividing a stricture situated anterior to the bulb, in the straight part of the canal. If the nature of the stricture does not, however, admit of the use of this instrument, dilatation by the gentle introduction of the catheter, bougie, injection of water, or the application of caustic, and the patient be still suffering from retention of urine, and probably threatened with ulceration of the urethra behind the stricture, the bladder must necessarily be punctured. The operation may be performed either by puncturing the bladder through the rectum, above the pubes, or by making an incision into the perineum. I have, generally speaking, an objection to the operation per rectum, for, although it is performed with great facility, it interferes with the functions of an important organ, in addition to those implicated in the disease, and the patient is merely relieved from the retention of urine, without the cause of the evil being removed. Some surgeons maintain that the stricture is much more readily cured when the urine is made to pass off by another channel, as it is then no longer subjected to the pressure of the urine, or the irritating influence of constant attempts at micturition. My experience does not, however, lead me to this opinion, as it still requires much time to remove the obstruction; and during this period, a canula sufficiently long to protrude from the anus must be left in the opening between the bladder and rectum; and as this instrument must irritate the rectum by its presence, it would produce a liability to permanent fistula. There may, however, be cases in which puncturing the bladder per rectum may be resorted to with advantage; as, for example, when a stricture which had long remained permeable had suddenly become irritable, producing retention of urine, with symptoms so violent as to require immediate relief. In such a case it is to be hoped that the aggravated condition of the stricture merely arises from some temporary cause, and that as this is subdued, owing to the water having another passage, the stricture will again become pervious;

and there would be no necessity for keeping the canula long in the opening between the rectum and bladder. When the stricture has long been impervious to the bougie, puncture per rectum is, I think, always injudicious, and the operation in perineo ought to be adopted instead. My colleague, Mr. Cock, has frequently performed the operation per rectum in cases where immediate relief was necessary from the urgency of the symptoms; and the circumstance of his having repeated it, is, in my opinion, a guarantee for its expediency in certain cases. In this operation, the patient should be placed in the same position as in that for lithotomy: the fore-finger of the left hand must be passed up the rectum beyond the prostate gland, and upon the patient's coughing, the inferior region of the bladder may be felt pressing on the rectum. A long curved canula should then be passed along the finger and pressed against the bladder, being held in such a direction that the extremity points towards the umbilicus. The trocar is next passed along the canula, and plunged into the bladder; and on the trocar being withdrawn, the urine immediately follows it.

In cases of enlarged prostate this operation should certainly never be performed, as there is danger of wounding the third lobe of the gland. And, moreover, before the operation is decided on, it should be ascertained that the bladder is really distended by urine, and not thickened by hypertrophy, in which case the urine may be contained in abnormally distended ureters, and in the pelvis of the kidney, and not in the bladder. In such cases, the stricture itself should be operated on, and not the bladder.

The bladder is sometimes punctured above the pubes for the purpose of relieving insuperable retention of urine, but to a certain extent the same objection exists to this as to the puncture of the bladder per rectum, as it merely relieves the retention without removing the stricture, which is the cause of obstruction to the passage of the water through the urethra. This operation, considered only as a ready mode of drawing off the water, certainly offers some facilities, but the subsequent danger of infiltration of urine into the cavity of the pelvis is a great objection to its adoption.

The operation is performed by making an incision an inch and a half long through the skin in the median line immediately above the pubes; and having laid bare the linea alba, that is also to be divided to the same extent. The anterior region of the bladder, uncovered by peritoneum, will now be exposed, and a trocar and canula must be plunged into it, and the water drawn off. The canula should be sufficiently long to permit its being retained in the bladder when that viscus recedes as the water is evacuated, otherwise extravasation of the urine would take place; to prevent the subsequent occurrence of this, means must be employed to retain the canula in the proper place, and to keep the patient in such a position as would guard against such an accident. The same difficulty, however, occurs as in the operation per rectum, as to the period at which the canula may be withdrawn, for the permeable condition of the urethra has subsequently to be restored.

I knew a farmer at Chipping Ongar, who for the last twelve years of his life was constantly obliged to wear the instrument—a fact which shows that the operation had only relieved the retention, without effecting the removal of its cause. When a patient who has difficulty in passing his water, and is subject to frequent attacks of partial retention, applies to the surgeon, and it is found impossible to pass an instrument into the bladder, and that the symptoms are not relieved by warm bath, opium, and the other remedies that have already been mentioned,—and also that the stricture has not yielded to the means employed for its dilatation, nor to the action of caustic,—I believe the most advisable operation is that of cutting through the stricture in perineo, as by this plan we not only radically overcome the obstruction, but relieve the retention of urine at the same time. It is true this operation is more difficult than the others, but that in itself offers no reasonable objection to its adoption, if it actually affords more benefit to the patient. The cause of its frequent failure arises from the delay, which frequently leads to great constitutional disturbance before the operation is had recourse to, rather than from the difficulties existing in the operation itself.

In the operation of *dividing the stricture in perineo*, the patient is placed in the same position as in lithotomy: an instrument is passed down to the stricture (the grooved staff being perhaps the most appropriate to the purpose). An incision is next made in the perineum, commencing at the point where the end of the instrument can be felt resting on the stricture; the groove is then to be cut into, and the knife carried downwards with great caution, cutting a way for the point of the staff, which should be made to follow it as it gradually divides the stricture; the staff being pushed on then passes into the bladder. The staff should then be withdrawn, and an elastic gum catheter put in its place, and retained there for several days. I have generally adopted another plan in performing this operation, as in most of the cases fistulous opening in the perineum was concomitant with the stricture. The following is the modification I have used of this operation. Having made the incision into the perineum, instead of opening the urethra at the groove of the staff as before described, I have first opened the membranous part of the urethra behind the stricture, and then passed a female catheter into the bladder, and drawn off the urine: relieving the patient of the retention, but having still to divide the stricture: this is effected by feeling within the wound for the point of the grooved staff above the stricture; and, proceeding to cut through the obstruction, carrying forward the staff as before described,—first, however, having withdrawn the female catheter,—the staff enters the bladder through the opening originally made for that instrument. The staff should then be withdrawn, and an elastic gum catheter inserted in its stead: this should be left in for a week, when it must be removed, and substituted by a new one. At first, some urine will escape by the wound through the perineum, as in the operation for lithotomy; but generally in the course of a week or ten days it passes entirely through the catheter. About a fortnight after it has entirely ceased to flow from the wound in the perineum, the catheter should be removed, but still for some time the patient should regularly have the water drawn off, and this, if performed with gentleness, produces much less irritation than would be excited by the constant presence of an instrument in the bladder. I have, at the present time, a gentleman under my care, on whom the above operation was performed ten days since, and the urine has ceased to flow from the perineum, but he continues to employ the catheter to empty the bladder. I have performed this operation many times, and am convinced that if resorted to in an early stage of the disease, or at least immediately after the appearance of urgent symptoms, there are few cases in which it would not prove successful; but, on the other hand, in protracted cases, success is very doubtful. When a permanent stricture occurs in the urethra anterior to the bulb, especially in that part of the canal covered by scrotum, it is not advisable to cut down upon it from without, owing to the liability to infiltration of urine if the incision be made through the scrotum, and to the difficulty of healing the wound when the opening is made anterior to the scrotum. The cure of such strictures must, therefore, be attempted by the use of bougies or caustic, or, should they resist this treatment, perhaps the instrument, furnished with a cutting stilette, employed by Mr. Stafford, may be used: for as this part of the urethra may be rendered straight, the instrument may be directed with much more certainty than when the stricture is seated in the curved portion of the canal. I should, however, prefer opening the urethra behind the stricture, if retention demanded it, to puncturing the stricture itself.

Obstructions in the urethra sometimes occur from the lodgment of a small calculus in the passage, and this may produce retention of urine, without any premonitory symptoms leading either the patient or the surgeon to suspect the cause of the obstruction. There may have been, however, pain in the loins, nausea, and retraction of the testicle; and the sudden cessation of these symptoms, probably from the use of a warm bath, or a dose of opium, would lead to a suspicion of the cause of the retention, and would necessarily preclude any attempt to pass an instrument, as there would be a liability to push the stone back again into the bladder; and this would lead to the necessity for some *future* serious operation for its removal. Should, however, the foreign body in the urethra produce decided retention, it must be removed, either by a pair of forceps passed down the urethra for the purpose of crushing it, or by cutting down upon it and removing it whole; in the latter case, the patient should not be allowed to pass his water without the use of an instrument, or a permanent fistulous opening is almost certain to result: in these cases, however, the wound heals much more readily than in cases of stricture; which is easily explicable, as in the former case the urethra is healthy, while in the latter its diseased condition prevents the ready re-union of the divided parts. I have frequently treated cases, both where the presence of the stone was manifest, and where its existence was merely suspected from the suddenness with which the obstruction occurred. I was once sent for to a gentleman, at Mould's Hotel, who had been seized with retention of urine, to which, indeed, he told me he had been subject upon several occasions. With considerable difficulty I succeeded in passing an instrument and drawing off his water: he remained under my care for about ten days, during which period I had occasion to use the catheter three or four times, and never detected the presence of a stone; one day, however, shortly after I had left him, a calculus of considerable size passed from the urethra, and he has remained perfectly well ever since. The anomaly in this case is, how the catheter could pass the stone without giving evidence of its presence; but I suspect that it had lodged in the bulb, where it had, perhaps, formed a kind of pouch, and I also believe that its formation had taken place in the prostate gland, as it proved to be phosphate of lime; and this would account for the absence of symptoms of the passage of the stone from the kidney into the bladder.

I was sent for to a patient who had suddenly been attacked by insuperable retention of urine, unattended by any premonitory symptoms: he stated that he had never been the subject of stricture or any other disturbance to the passage of his urine: upon attempting to pass a catheter, I found the meatus of the urethra so contracted, that No. 6 could not be introduced. I was therefore obliged to substitute a smaller instrument, which, although it entered the passage, was immediately stopped by some foreign substance: with a probe-pointed bistoury I enlarged the mouth of the urethra, and with a pair of small "dressing forceps" easily removed a calculus, which I found to be the only cause of the obstruction to the passage of the urine.

Some time ago I was called to a friend, who was attacked with retention of urine, having previously suffered all the symptoms of a stone passing from the kidney, along the ureter, into the bladder. Having had an opportunity of becoming aware of the premonitory symptoms, it immediately occurred to me, that the retention was caused by a small stone having become impacted in the urethra. I could not, therefore, use the catheter to draw off the water, from the fear of pushing the stone back into the bladder. I explained this to the patient, and begged him to bear the pain as well as he could. In the meantime I gave him a dose of opium, ordered him a hot bath, and then desired him to lie down, and remain quiet, until the necessity to make water became so imperative that he could no longer withstand it. He was then to make a violent effort to propel the urine from the urethra, so that if a stone were the cause of the obstruction, the mechanical force of the flow of urine might be sufficient to dislodge it. Two or three hours after this, a small calculus was expelled; it consisted of uric acid, as I expected, from the habits and diathesis of the patient.

LECTURE XLV.

CONTINUATION OF GENITO-URINARY ORGANS.

Fistulous openings into the perineum—Abscess in perineo—Treatment—Case—Diseases of the prostate gland—The prostate both a urinary and generative organ—Tendency to sudden enlargement—Anatomical characters—Morbid sensibility of the vasa deferentia—Symptoms—Treatment—Inflammation of the prostate gland—Treatment—Abscess in the prostate—Symptoms—Diagnosis—Opening of the abscess—Spontaneous evacuation of the pus into the rectum or urethra—Treatment—Ulceration of the prostate—Calculi in the prostate—Cases—Enlargement of the prostate in old age scarcely to be considered a disease—Symptoms—Case—Fungous disease of the prostate—Case—Diagnosis.

Diseases of the bladder—The bladder only an excreting organ—Inflammation of bladder—Paralysis of bladder—Case—Hypertrophy of the coats of the bladder—Ulceration—Symptoms—Sloughing of mucous membrane.

Retention of urine, whether arising from permanent stricture, the presence of calculus, or, indeed, any cause which prevents the flow of the urine, may be spontaneously relieved by ulceration of the urethra behind the cause of obstruction; from this, extravasation of urine, and subsequently abscesses, must necessarily result; and fistulous openings being established, the patient is relieved by the flow of urine through them. Such a condition must not, however, be allowed to remain; and it is quite clear that the fistula cannot be cured without the stricture being divided, so that the natural canal for the passage of the urine may be restored. Mere puncture of the bladder in such cases would be quite ineffective in relieving the patient; and the cure can only be produced by dividing the stricture in perineo, as I have already described, and by freely laying open all the sinuses, however numerous they may be. A gentleman, from Barbadoes, came under my care, who had not only been the subject of stricture for several years, but had also fistulous openings into the perineum, scrotum, and even into the rectum. In this case, I first divided the stricture in perineo, and passed a large catheter into the bladder; I then laid open all the sinuses, and divided the sphincter ani muscle. In three months the patient was perfectly cured.

Abscesses in the perineum are sometimes the result of stricture, even when the obstruction is not sufficient to produce actual retention of urine. These abscesses occur from the dilatation of the urethra behind the stricture, producing ulceration of its structures, and consequent infiltration of urine: in such cases, swelling in the perineum soon comes on, and rigors indicate the formation of pus. A free opening into the perineum should be immediately made, and the catheter passed, if possible, along the natural passage of the urethra into the bladder: if this cannot be effected at the time, repeated gentle efforts must be made to restore the normal continuity of the canal. Such ulceration of the urethra may, however, occur, as I have already said, without the presence of an impermeable stricture; so that it frequently happens, in such cases, that the catheter passes readily into the bladder without meeting any very considerable obstruction: the passing of the catheter should never be attempted, however, until the abscess be opened, as the accumulated matter itself might cause a considerable impediment to the passage of the instrument. The following case affords an example of this fact:—I was sent for to see a patient who was suffering from retention of urine; the symptoms were so urgent that I immediately attempted to pass a catheter; not succeeding, however, I proceeded to examine the perineum, where I discovered a tumour of considerable size; into this I made an incision, and a quantity of pus and urine was immediately evacuated. As the patient stated that he had been the subject of stricture for many years, I considered it better to open at once the membranous part of the urethra. I therefore passed a female catheter into the bladder, and, drawing off the urine, relieved the patient from the symptoms arising from the retention; I next passed a male catheter along the natural passage of the urethra, as a preliminary to the division of the stricture; to my great surprise, the instrument readily passed on, and when the female catheter was withdrawn, entered the bladder: this circumstance showed that if I had attempted to pass the male catheter before I divided the membranous portion of the urethra, I should have found the more formidable part of the operation to be altogether unnecessary. The experience I obtained from this case has since often prevented me from cutting into the membranous part of the urethra, after opening an abscess, in perineo, without first attempting to pass the male catheter along the natural course of the urethra: such a precaution is, indeed, rendered doubly necessary by the fact that abscesses in the perineum may result from external injury, without any other implication of the urethra than that arising from the mere pressure of accumulated matter, the evacuation of which immediately relieves the symptoms.

Diseases of the prostate gland.—It is somewhat difficult to decide whether the prostate gland is most important as a urinary or as a generative organ; as its diseases interfere, however, with the performance of both these functions, it may rationally be viewed in relation to them both. The prostate gland is composed of numerous follicles connected by a dense cellular membrane; but it is not furnished with a distinct capsule,—which circumstance probably accounts, at least in some measure, for its tendency to undergo sudden enlargement. The excretory ducts of the prostate gland, which are from fifteen to twenty in number, terminate in the prostatic portion of the urethra, by the sides of the veru-montanum; and if the urethra be laid open at this part, the secretions may be seen to exude when the gland is subjected to pressure. The natural form of the prostate gland is that of a chesnut, divided by a raphé or longitudinal fissure into two lateral lobes. The fissure is much more defined on the inferior than on the superior surface; at the posterior and inferior part of the gland there exists a small process, which connects the lateral lobes, and which is sometimes termed the third lobe of the prostate. The prostate gland is remarkable for its liability to undergo enlargement at an advanced period of life; this complaint is, indeed, so common that it can scarcely be looked upon in the light of a disease. The effects of enlargement of the prostate are, however, very important, as it produces an impediment to the passage of the urine, and is by far the most frequent cause of retention of urine in old age. The urethra traverses the prostate gland, but not exactly through its centre, being nearer to the upper than to the under surface; this is termed the prostatic portion of the urethra, and in it the ducts of the vesiculæ seminales and vasa deferentia have their terminations. The urethra, where it passes through the prostate, is subject to a disease which cannot, however, be regarded as an affection of the gland itself; the symptoms of the complaint are—pain at the neck of the bladder, aggravated during micturition, and a degree of difficulty in passing the urine, which sometimes leads to a suspicion of the presence of stricture. If the supposed obstruction be sought for by the bougie, intense pain is experienced as the instrument enters the prostate, and the patient complains of a great aggravation of the symptoms "in coitu:" the latter peculiarity forms the principal diagnostic mark of the disease, which consists in a morbid sensibility of the extremities of the vasa deferentia where they enter the urethra. This affection is produced by enlargement of the extremities of the vasa deferentia, which throw out papillæ-like projections that are extremely sensitive, and form obstructions to the passage of the urine and semen. The caustic bougie is the best remedy for this complaint, to which I believe Lallemand was the first to direct the attention of surgeons. I have two or three times seen it, and recognised it from its seat being in the prostatic portion of the urethra (a part very seldom the subject of stricture), and from the pain in coition, and during the passage of the urine, as well as from the sympathetic tenderness of the testicle itself. The application of caustic effected a cure in these cases; but subsequent experience has shown me that caustic is not invariably an effectual remedy in this disease.

The prostate gland is liable to *inflammation*, which is very often induced by the extension of gonorrhœal inflammation; it is indicated by pain in the perineum, extending into the region of the rectum, the pain being greatly aggravated while the patient is sitting. The bladder becomes affected, if immediate relief be not afforded to the inflamed gland, and even retention of urine often supervenes. The treatment consists in the application of leeches to the perineum, cupping in the loins, keeping the patient in the recumbent posture, suppositories, the use of diluents, and the removal of accumulated fæces from the large intestines. If these means be employed, the attack generally yields at once; but if they be not sufficiently active, the inflammation may acquire a chronic form, which is extremely difficult to overcome, and which, indeed, frequently leads to abscess.

Abscess in the prostate gland.—When an abscess has formed in the prostate, the pain is completely changed in its character, becoming rather an obtuse throbbing sensation, which is much aggravated during the act of defæcation; rigors also supervene, and sometimes the shivering fit is so distinctly intermittent, that the affection may be mistaken for ague. The difficulty in passing the urine is increased by the formation of matter, and an examination of the prostate gland should now be made per rectum; when, it is said, fluctuation may be discovered: I must, however, acknowledge that I could never detect it by this method of investigation. In abscess of the prostate, the catheter must be employed, notwithstanding the pain which is produced by its introduction, and although an obstruction is felt in passing the instrument through the prostate: the resistance is not similar to that of stricture; moreover, as stricture never occurs at this part, the diagnosis of prostatic abscess is comparatively easy. There is another point worthy observation; in abscess, the obstruction returns immediately after the removal of the catheter or bougie, to the same extent as before its introduction: this is not the case with stricture of the urethra. Should the duration of the symptoms be greatly prolonged, and the constitution of the patient deteriorated by continued suffering, the abscess should be opened by making a deep incision into the perineum, and then passing a bistoury into the gland to evacuate the matter. In this operation, the urethra should be carefully avoided, so that the matter may pass off by the factitious opening alone. Abscesses in the prostate sometimes burst spontaneously, either into the urethra or rectum, and this is generally indicated, in the case of the former, by the urine being mixed with pus, and by the immediate relief from pain; but when the tumour bursts into the rectum, the only sign of the evacuation of the matter would be the complete cessation of all suffering. The opening between the urethra and prostate, formed by the bursting of an abscess, is frequently very difficult to cure, owing to the urine infiltrating into the prostate, and keeping up a constant irritation: this difficulty may, however, be overcome by the gentle introduction of a catheter, to draw off the water for a few days,—until indeed the abscess has granulated. Should there be much difficulty in healing an opening between the rectum and the prostate, owing to the intrusion of the feculent matter into the gland, the division of the sphincter ani seems to be the best means of effecting the cure of the fistula. Sir Benjamin Brodie has recorded some cases of abscess in the prostate gland in children, which occurred in his own practice. I have never met with a case myself, and consider it rather a disease of the adult period than one of youth or old age.

Ulceration of the prostate gland.—This sometimes arises from inflammation, but much more frequently, I believe, from the presence of calculi in the prostate: it is attended by the most excruciating pain, and by occasional bleeding. Caustic is the best remedy: it may be passed down by a "port caustique:" in two or three instances in which I have known it to be used, it has produced the most beneficial effect.

Calculi in the prostate.—This disease is not very uncommon, but generally remains unsuspected until a small calculus ulcerates into the urethra, causing retention of urine: sometimes, however, premonitory symptoms present themselves, resembling those already described as being attendant upon inflammation of the gland. Some time ago I was sent for to visit a gentleman in Westbourne Terrace, who had been suddenly seized with retention of urine; he told me that he suspected the presence of a stone, as a few days before he had passed a small one during micturition. On introducing a catheter into the urethra, I met with an obstruction, just anterior to the bulb, but I did not attempt to overcome it, on account of the danger of pushing it back into the bladder should it prove to be a stone. The symptoms of retention not being very urgent, I ordered a hot bath and a large dose of opium, and four hours after he passed a calculus weighing five grains. The formation of stone in the prostate is not, however, always attended by so little inconvenience; the most acute suffering I ever witnessed, and which indeed led ultimately to the death of the patient, was in a case of this kind. The patient was under the care of Sir Astley Cooper, who attempted to remove the calculi from the prostate by means of the scoop, having cut down upon the gland, as in the operation for stone; but as the calculi were contained within the follicles of the gland, so as to be sacculated, it was found impossible to remove them all, and the sufferings of the patient remained unrelieved; and, the result was, that his constitution and mind at length became so worn by the continual agony, that he put an end to his existence.

Enlargement of the prostate in old age.—This can scarcely be regarded as a disease, but appears to be the result of a change inseparable from old age. It certainly sometimes attacks individuals in comparatively early life, but such persons always manifest more or less the signs of premature decrepitude. The enlargement seems to be true hypertrophy, as it is rarely attended by any alteration of texture. The urgency of the symptoms in enlargement of the prostate gland depends upon the size it has acquired; they are, sensation of weight in the perineum, intolerance of pressure from the hardness of a seat; difficulty in passing the urine and fæces; the latter being flattened by the encroachment of the hypertrophied gland on the rectum. At this stage of the complaint, retention of urine occasionally supervenes, and must be relieved by the introduction of a catheter. This operation should be performed with the utmost gentleness, as the slightest flow of blood causes decomposition of the urine, and consequent aggravation of all the symptoms. An elastic gum catheter should always be preferred for drawing off the water, and, if possible, it should be introduced without a stilette; leeches should be applied to the perineum; the rectum emptied by means of enemata; and suppositories, recumbent position, and soothing remedies employed. I have also found colchicum of great use in such cases, and believe that its beneficial influence arises from the circumstance that the disease frequently attacks subjects of a gouty diathesis. I usually prescribe the colchicum in the following form:—

℞ Extr. Colchici. acet. gr. j.
Pil. Hydrarg. gr. j.
Pulv. Doveri, gr. v.
Ext. Colocynth. co. gr. iij. M.
Ft. pil. ij. bis quotidie sumendæ.

As the complaint takes its origin from a particular epoch of life, nothing beyond relief of the symptoms can be expected; but by a judicious system of diet, by keeping the patient from excess of bodily exertion, and from vicissitudes of temperature, his life, which was scarcely supportable under the violent symptoms of the disease, is rendered comparatively free from pain and inconvenience.

It does not always happen that the whole of the prostate gland becomes hypertrophied in old age; but very frequently the third lobe only is affected, or perhaps it may more properly be said that a new development arises; for in a state of health, at the adult period, the third lobe is scarcely perceptible. When this third lobe enlarges, it presses the inferior region of the bladder or "trigone" upwards above the commencement of the urethra in the bladder, preventing the evacuation of the urine, and consequently producing retention. Nor is this the only inconvenience; for, by the raising of the inferior region of the bladder, a kind of reservoir is established immediately behind the prostate and below the entrance to the urethra, so that a portion of the contents of the bladder always escapes evacuation; this becomes specifically heavier than the newly-secreted urine, which does not intermix with it; after a time, the retained urine undergoes decomposition, and gives rise to very urgent symptoms—such as frequent desire to make water, tenesmus, deep-seated pain in the perineum, and liability to positive retention. It is quite clear that these symptoms cannot be removed while the exciting cause remains; the fœtid urine must therefore be immediately drawn off by means of the catheter. In such cases there is, however, some difficulty in passing the instrument, as the enlarged lobe offers an obstruction to its passage, and this is only to be overcome by employing a longer and larger catheter than that usually made use of: this instrument is generally termed the prostatic catheter. The mode of introducing the catheter in such cases is similar to that in ordinary practice, until it arrives at the point of obstruction, when the penis and instrument are both to be drawn forwards for the purpose of straightening the urethra; the handle of the catheter is then to be considerably depressed, so as to tilt up its point; it is then pressed onwards into the bladder. Having however passed the catheter, the urine would only be drawn off to the level of the urethra, and the heavier fluid would still remain, unless some further means were employed for its removal. The cleansing of the bladder may be effected by injecting it with tepid water, by means of a syringe; and an improved instrument has been invented for this purpose, by which a continuous current is kept up, the same stroke of the piston removing one quantity and supplying a fresh one. Constitutional remedies must not be neglected in these cases; and, when an alkaline state of the urine exists, medicines of an acid character are generally indicated. Among the most efficacious of these will be found the following :—

℞ Acid. Nitro-Hydrochlor., gtt. iij.
Syr. Papav. ʒij.
Inf. Colomb. ℥iss. M.

Ft. haustus ter quotidie sumendus.

In addition to this, an opiate suppository at bed-time will often be found of great advantage; but if an acid condition of the urine be not thus restored, liq. potassæ will frequently be found capable of re-establishing the normal acid state; this anomaly has been accounted for by the supposition that the alkali renders the secreted urine less irritating to the mucous membrane of the bladder, and prevents the secretion of alkaline mucus, from which the urine had acquired its abundant preponderance of alkali.

I must again direct attention to the propriety of employing the prostatic catheter in enlarged prostate; for I have frequently known great mischief arise from a perseverance in the attempt to relieve a patient by the ordinary instrument.

Not many weeks ago I was sent for to see a patient who was said by his medical attendant to be suffering from suppression of urine. When I saw the patient, I found that he had an enormously distended bladder, and it appeared to me that he was suffering from retention, and not suppression. I mentioned this, but the surgeon said, in reply, " I will prove it to be suppression;" and he accordingly passed a catheter to its full extent, without being able to draw off a drop of urine. I then sent for a case of catheters, introduced the prostatic catheter, and drew off nearly three pints of highly ammoniacal and fœtid urine. The treatment I have previously described was adopted in this case; and although for some days the patient could not voluntarily evacuate the urine, he now only requires the occasional washing out of the bladder.

In passing the prostatic catheter (as, indeed, all others) the utmost gentleness and caution are requisite; for, as I have mentioned before, the least flow of blood, owing to its reaction upon the urine, increases all the symptoms in a tenfold degree.

I have on two or three occasions met with a disease of the prostate gland which I do not remember to have seen described by any author. A short recital of the cases themselves will perhaps be the best means of describing to you the symptoms of the complaint:—

Thomas Harriet, aged 70, was admitted into Guy's Hospital, suffering from great difficulty in micturition, and pain in the rectum and region of the bladder. I attributed the symptoms to enlargement of the prostate, and proceeded to pass the prostatic catheter. When I had introduced the instrument as far as the point of obstruction, upon depressing the handle to overcome the impediment, the catheter passed on, giving at the time a sensation to the hand as if the instrument had been forced through a piece of rotten sponge. A large quantity of water was drawn off, the latter portion of which was mixed with a great deal of blood, and the bladder soon became again distended, indicating that the bleeding continued. The next day, the patient not having passed any water, the catheter was again employed, but nothing but a few clots of blood came away. I next proceeded to wash out the bladder by injecting tepid water; and I thus succeeded in bringing away so much blood as materially to diminish the distention. The urgency of the symptoms, however, increased, and it was necessary to pass the instrument very frequently, producing an almost constant flow of blood; consequently, in a few days the patient sunk from complete exhaustion. Upon a post-mortem examination, the bladder was found distended, presenting an irregular figure, owing to a considerable projection having formed near its fundus on the right side, and one still larger extending between the bladder and rectum. The bladder was opened: its parietes were much thickened, and the lining membrane of a dark colour; the most remarkable appearance was, however, presented at the prostate gland; the middle lobe was enlarged, and nearly of the size of a pullet's egg, of a dark wine-lees colour, and very soft texture, converted, indeed, into a fungous mass, from which the hæmorrhage had proceeded. The irregularities on the outside of the bladder proved to be diverticula formed by the projection of the mucous membrane between the fibres of its muscular coating.

William Johnston, aged 72, came into Guy's Hospital, in 1836: he was suffering from retention of urine, and stated that two days before his admission he had been much alarmed by passing a considerable quantity of blood by the urethra, having never previously experienced any derangement of the urinary organs. This spontaneous effusion of blood was followed by great difficulty in making water, attended, however, by a constant desire to do so; and by a great effort small quantities of bloody urine were expelled. A large catheter was easily passed into the bladder, and a pint of bloody urine withdrawn; but this afforded only temporary relief, as the retention soon returned, so that the use of the catheter had to be repeated. This produced an aggravation of the symptoms: lead and opium were prescribed, and also mineral acids, but only at intervals, so as not to interfere with the action of the lead; all proved, however, unavailing to check the disease, and in a few days the patient died. Upon examination after death, the bladder was found distended, and connected by old adhesions to the parietes of the abdomen and folds of the small intestines. The lining membrane seemed to have been in great measure removed, and was replaced by a loose flocculent membrane, which was of a very dark colour; the prostate gland was somewhat enlarged, the third lobe being of a globular form, and projecting into the bladder. The orifice of the right ureter was free, but immediately upon the opening of the left was seated a hemispherical fungus of the size of a large chesnut, attached at the centre of its flat surface by a short peduncular process: the tumour was highly vascular, and was evidently the source of the hæmorrhage. The left ureter and pelvis of the left kidney were very much distended.

The diagnosis of malignant disease in such cases must, I think, always be tolerably clear from the obstinate tendency to bleeding, and perhaps from the cachectic manifestations of the patient, if much confidence can be placed in what is termed the aspect of malignant diathesis.

Diseases of the bladder.—As the bladder is only an excretory organ, it is subject to few diseases that do not take their origin from interruption to the due and proper evacuation of the urine. It is true that the organization of the bladder is similar to that of other structures of the animal system, and, therefore, it must sometimes undergo deterioration from the diminished power of its capillaries to eliminate from the blood those constituents which are essential to maintain the integrity of its tissues. Disease of the bladder most frequently arises in consequence of those morbid conditions of the urethra and prostate gland just described—the exciting cause being retention of the urine, which produces decomposition of that fluid, and subsequent inflammation of the mucous membrane, muscular coat, or peritoneal covering of the bladder. A very frequent result of over-distention of the bladder is paralysis, which then becomes a cause of retention, as the bladder is no longer capable of contracting upon its contents.

Paralysis of the bladder is supposed to proceed from excessive distention of its muscular coat, so that its vital irritability is impaired, or sometimes, when the distention is very great, completely destroyed. I believe, however, that mechanical distention alone is not sufficient to produce paralysis, without the concurrent influence of constitutional nervous derangement. The following case is an illustration of this:—I was consulted by a patient who had had retention of urine four days, from stricture of the urethra. With some difficulty I passed a catheter, and drew off a very large quantity of urine; the bladder, however, still retained its power of contraction: the urine drawn off was albuminous and acid, but the subsequent secretion contained only its natural constituents. Paralysis of the bladder may also occur in consequence of disease or injury to the spinal marrow; in such cases the paralysis is much more serious in character than when it results from mere over-distention. And, indeed, the affection of the bladder thus induced, is not unfrequently the cause of death, as the morbid changes produced in the secretions of its mucous membrane, reacting upon the urine, set free ammonia, which is a very powerful irritant, inflaming the parts, and giving rise to so much constitutional disturbance as ultimately to destroy the life of the patient.

The muscular coat of the bladder is subject to become thickened or hypertrophied, which necessarily diminishes the capacity of the organ: this effect may result from obstruction to the passage of the urine, from stricture, enlargement of the prostate, or the presence of calculus. The liability to this condition should always be borne in mind by the surgeon, wherever he considers it necessary to puncture the bladder for the relief of insuperable retention; for if it be in such a state,—no matter whether the obstruction depends upon the presence of stone, enlarged prostate, or stricture,—the operation in perineo is peremptorily indicated.

Inflammation of the bladder sometimes arises from an extension of gonorrhœal inflammation along the urethra: and is produced by the sudden suppression of gonorrhœal discharge. This affection is indicated by what is termed irritable bladder, where there is frequent desire to pass the water, but very little is voided; more or less constitutional disturbance, and a constipated state of the bowels, are also usually present.

The treatment consists in the administration of calomel and opium, hot bath, enemata, diluents, suppositories, and keeping the patient in the recumbent position. Sometimes, however, it will be found very difficult to subdue the symptoms. Injections of a solution of opium into the bladder are recommended, but I have found them productive of mischief rather than good. I have, however, known great benefit derived from cupping in the loins, and the application of leeches over the pubes; and in one case the patient was rapidly relieved by the injection of ice-cold water into the rectum.

Inflammation of the mucous membrane of the bladder may go on to ulceration; and in post-mortem examinations I have frequently met instances in which the whole of the mucous coating of the bladder had been thus removed. The symptoms attending this disease are of the most urgent character, the pain is excessive, and but little relief is afforded by the evacuation of the urine; for the mere contraction of the bladder necessary to micturition produces great irritation in the inflamed mucous membrane.

Weak solutions of nitrate of silver have been recommended in such cases, but I believe that injection of any kind seldom produces a good effect when the bladder is ulcerated. Opiates and suppositories are the best means of treatment, but, under any circumstances, ulceration of the bladder generally proves fatal. In obstinate cases of retention of urine from permanent stricture, even sloughing of the mucous membrane may sometimes take place, and the liability to this condition from protracted distention, shows the necessity for the early operation of puncturing the bladder to afford relief.

LECTURE XLVI.

STONE IN THE BLADDER.

The result of defective elimination, or of the intrusion of a foreign body into the bladder—Premonitory symptoms of gravel and stone—Stone in the kidney—Symptoms—Stone in the ureter—Symptoms—Discharge of the stone by ulceration—Case—Treatment—Medical treatment in premonitory symptoms of stone—Stone in the bladder—Indications of the stone having passed into the bladder—Means of promoting its discharge—Use of forceps—Symptoms of stone in the bladder in children—Symptoms simulating those of stone—Treatment—Cases—Detection of the stone—Sounding—Its use—Prognosis in stone—Size of calculi—Cases—Symptoms not generally severe in proportion to the size of the stone—Cases—Sir Astley Cooper's case of 142 *calculi in the same bladder.*

Before I enter into an account of the symptoms of stone in the bladder, I must call your attention, gentlemen, to those interruptions to natural function which evidently show, that in most cases, urinary concretions are the result of imperfect elimination from the blood, owing to that fluid being defective, from a deterioration in the assimilative powers of the system. Urinary calculi may therefore frequently be attributed to a disordered state of the digestive organs, and dyspeptic symptoms are usually more or less concomitant with the formation of these concretions. It is true that an imperfect elimination of healthy urine may also proceed from disease in the secreting part of the kidney itself; but this would be shown by a train of symptoms indicative of kidney disease. Another source of stone may be the accidental intrusion of a foreign body into the bladder; but, under any circumstances, stone can only be the result of a secondary action. Indigestion is too wide a field to be dwelt upon in this lecture; but it must be evident that a healthy condition of the assimilative powers is requisite to produce pure blood, and from this alone can normal urine be eliminated; so that, if there be any circumstance to disturb the due performance of the digestive function, the integrity of the blood will be destroyed, and the kidnies will be no longer capable of secreting or excreting urine in its natural state.

Of the diseases of the kidnies in connexion with the formation of calculi, little can be known until we possess a more perfect knowledge of the physiology of secretion; but when we consider that the formation of the urine for excretory purposes is one of the great means for the depuration of the blood, it is certain that a morbid condition of the secerning portion of the kidney would cause a change in the character of the urine secreted, and probably, at the same time, the deposition of its earthy and alkaline constituents. When a foreign body is lodged in the bladder, such as a fragment of broken bougie, or portion of fibrin, the urinous salts almost invariably concrete around it. Under these circumstances, the urine undergoes further change, in consequence of the secreted mucus being rendered abnormal, from the irritation caused by the intruding substance. This deposition of the salts is somewhat analogous to the crystallization which takes place upon a body suspended in a saturated saline solution. The premonitory symptoms of gravel or stone arising from defective assimilation are, dyspepsia, and an abnormal state of the urine, indicated by the quantity of the secretion being much diminished, by its turbidity, and by the frequent desire of the patient to pass it. It rarely, however, happens that these early symptoms fall under the notice of the surgeon: for, as the inconvenience is comparatively but slight, medical assistance is seldom sought until more urgent symptoms supervene.

Calculus in the kidney.—When the concretion has formed in the kidney, it gives rise to a series of acute symptoms which render medical aid at once necessary. The symptoms are, pain in the region of the kidney, extending into the epigastrium, frequently attended by vomiting, great intolerance of the stooping position, and not unfrequently by the evacuation of bloody urine. These symptoms are sometimes spontaneously relieved by the stone passing from the kidney through the ureter into the bladder; but in more urgent cases the stone may ulcerate from the kidney, lead to the formation of an abscess in the loins, and so discharge itself; but if the stone does not make its escape either by the ureter or by ulceration, the concretion in the kidney may increase so as to fill up the whole of the excretory part of that organ, destroying its secerning function, and finally leading to the death of the patient. In the post-mortem examination of such cases, the tubuli uriniferi, infundibula, and pelvis of the kidney, are frequently found filled with calcareous matter.

Stone in the ureter.—When the stone reaches the ureter, in its passage from the kidney to the bladder, it produces very similar symptoms to those already described as indicating its formation in the kidney; but the pain becomes erratic, extending from the loins downwards in the direction of the psoas muscle, and is often attended by a sensation of uneasiness at the superior spinous process of the ileum. As the calculus descends through the course of the ureter, it irritates the spermatic plexus of nerves, and produces spasmodic contraction of the cremaster muscle, with consequent retraction of the testicle, and frequent and severe sickness. Occasionally these symptoms suddenly disappear; this indicates that the stone has passed from the ureter into the bladder; while at other times the stone, being too large to pass, induces a high degree of inflammation, causing ulceration, by which process the calculus has been known to be discharged into the colon, or, by means of abscess, through the loins. The following is a case in which such a result occurred: —A patient of Sir Astley Cooper was supposed to be in the last stage of anæmia from protracted discharge from a lumbar abscess. A new feature had, however, arisen in the case, from the appearance of what was supposed to be a piece of bone, which prevented the free discharge of the pus. Sir Astley Cooper enlarged the opening to remove this solid body, which he found, to his great surprise, to be a urinary calculus of considerable size. Other cases are mentioned in which calculi have passed along the ureter as far as the point where it terminates in the bladder, and, becoming impacted there, have produced the most severe and urgent symptoms. The exact position of the stone may be diagnosed by the circumstance of the pain having become quite fixed, instead of shifting its situation, as it does when the calculus moves along the ureter. Having ascertained, by passing the finger up the rectum, and by the sound, that the stone is fixed in the ureter, there would be no alternative but to cut down through the rectum into the bladder, to remove the stone by the forceps, according to the plan of Dessault, or to open the bladder above the pubes. I consider the latter to be the safer and more certain operation. If the calculus becomes impacted higher up in the course of the ureter, so as to be beyond the reach of the surgeon, the ureter above the stone, the pelvis of the kidney, and the whole of its excretory part, become so distended by urine as to destroy its secreting power, and lead to suppression of urine, and the destruction of the life of the patient, the symptoms having been indicative of effusion into the cavities of the brain, the pericardium, and the serous membranes generally.

Medical treatment may do much for the relief of the premonitory symptoms which indicate a tendency to calculous concretions; and, therefore, the very first signs of dyspepsia should be combated, as the restoration of the assimilative powers to their normal vigour may prevent the occurrence of calcareous formations.

Treatment of premonitory symptoms.—When there is reason to suppose that dyspepsia is the exciting cause of the abnormal condition of the urine, and there exists at the same time a preponderance of acid in that fluid, I have found the following medicines very effectual in restoring the tone of the digestive organs:—

℞ Pil. Hydrarg. gr. j.
Pulv. Rhei, gr. v. M.
Ft. pil. horâ somni sumend.

℞ Amm. sesquicarb. ʒss.
Sodæ sesquicarb. ʒjss.
Pulv. Rhei, ℈ij.
Træ Card. co. ℥ss.
Inf. Gentian. co. ℥vijss. M.
Capt. cochl. larga ij. bis quotidie.

I have also found a grain of the acetic extract of colchicum, added to the pill, produce a very good effect. The restoration of the appetite, of the normal state of the urine, the removal of uneasiness in the region of the stomach, and of eructations after eating, are certain indications of the efficacy of the remedies: should they, however, fail to produce the desired effect, hydrocyanic acid and change of air will sometimes be found of great service. This treatment may be considered to relate to what may properly be termed the first stage of calculous disease, or rather, perhaps, to the diathetic tendency to it. In the second stage, viz., where the stone has already formed in the kidney, and the symptoms are, pain in the loins and in the course of the ureters, the hot bath must be employed, blood abstracted either by cupping or from the arm, and large doses of opium, with a purgative enema, be administered, to secure the emptying of the large intestines; for I believe that, in addition to the purgative effect, the increased peristaltic action of the bowel mechanically facilitates the passage of the stone along the ureter.

Stone in the bladder.—As I have already mentioned, the sudden cessation of all the urgent symptoms indicates that the stone has passed into the bladder: when this has taken place, the urine should be chemically examined for the purpose of ascertaining the nature of the change that has been produced in it, so that the tendency to the formation of such concretions may be combated by the appropriate remedies: the most effective means must also be adopted to promote the discharge of the newly-lodged calculus from the bladder: this object may often be effected by introducing large bougies into the urethra, and by the patient retaining his water until the bladder becomes distended, and the desire to micturate excessive; the urine should then be passed with the body bent forward, and with a violent effort, when the stone is sometimes forced along the urethra by the impetuosity of the stream. In passing the urine in this manner, it is advisable to void it on a small muslin bag, so that if any portions of calculous matter be passed they may be detected. If, however, these means of producing the spontaneous discharge of the stone by the urethra fail, in consequence of the size of the concretion being too great to allow the force of the water alone to discharge it, the "urethro-vesical forceps," invented by Sir Astley Cooper, may be employed; and many cases are recorded in which the efficacy of this instrument has been fully tested and established. Sir Astley Cooper describes some cases in which he removed large numbers of calculi from the same bladder by means of these forceps; and I believe that to this instrument may be attributed the invention of the lithotrite, which has proved so available in the practice of modern surgery.

When a stone has lodged in the bladder, and cannot be voided by the urethra, whether it has formed in the bladder itself, or passed into it from the kidnies, a train of symptoms is produced, by which we are enabled to distinguish its presence almost with certainty. The patient has great intolerance of motion, is generally easier in the recumbent than in the erect or sitting posture; when under exertion, there is a frequent desire to make water; but only a small quantity is passed at a time, and this is generally of a paler colour than is natural to the secretion. If the patient be subjected to a jolting motion, as in riding on horseback or in a cart, the desire to make water is much increased; but frequently, while flowing, it will stop suddenly, in consequence of the stone falling into the neck of the bladder, producing a violent spasm, frequently followed by a flow of bloody urine. During the paroxysm, a strong desire to evacuate the bowels is experienced; and the patient, to relieve his sufferings, bends his body forwards, keeping his legs separated, and, in this position, he voids the last drops of urine, complaining at the same time of a darting pain in the glans penis; thus referring the sensation to the extremities of the nerves, and not to the part immediately irritated by the stone. In children, elongation of the prepuce, from their pulling and pinching it during the paroxysms of pain, forms another symptom of stone; and prolapsus ani is also a frequent concomitant of this disease, especially before the age of puberty.

An ulcerated state of the bladder, certain diseased conditions of the prostate gland, or the presence of little sandy concretions, may produce symptoms closely resembling those of stone. I have also found, especially in children, symptoms simulating those of stone when none really existed; in such subjects, I have frequently met with a roughened state of the bladder, and on turning the sound its point passes over thickened and hardened rugæ, which I can only compare to the bars in the roof of a horse's mouth. The sensation thus communicated to the hand may easily be mistaken for that produced by the presence of a soft calculus; and I believe, that in cases where, upon operation, no calculus has been found, this roughened state of the bladder was the cause of the mistake: at the same time, it is worthy of remark, that this condition is rarely found concomitant with stone, and I therefore, in such cases, resort to constitutional remedies, and have found the following very effectual:—

℞ Liq. Potass. ʒij.
Muc. gum acac. ℥iss.
Træ. Hyos. ʒj.
Mist. Camphor. ℥vjss. M.
Capt. cochl. larg. ij. bis quotidie.

℞ Hydrarg. cum creta, gr. iij.
Pulv. Doveri, gr. iij. M.
Ft. pil. omni nocte sumenda.

A solution of sulphate of magnesia and chamomile tea will generally be required to keep the bowels in a natural state, owing to the constipating tendency of the other remedies. As an instance of symptoms similar to those of stone, and which proved to be unconnected with disease of the bladder, I consider the following case worth relating:—Major R. consulted me respecting his son, who was suffering from symptoms of stone, attended with great irritation along the course of the ureter: on sounding him, I could not detect a calculus, although he had suffered all the usual indications of the presence of stone for more than a year. He had been sounded by Mr. Hodson, of Lewes, and a surgeon of Brighton, both of whom had told the father that although they could not discover a calculus, they had little doubt of its existence. My friend, Dr. Golding Bird, analysed his urine at my request, and pronounced it healthy; but as there was considerable irritation about the bladder, I ordered him liquor. potass. with Træ. Hyoscy., from which he derived no relief. Dr. Bright then met me in consultation, and recommended a belladonna plaister to be applied to the loins, and prescribed decoc. pareiræ: these remedies were had recourse to, but without any beneficial effects. As at this period my patient complained of increased pain in the course of the left ureter, I was induced to make a strict examination of his person, to ascertain whether there existed any local cause to account for the symptoms, when I discovered that the left testicle was lodged in the inguinal canal. The slightest pressure on the testicle produced an aggravation of all the symptoms: I was therefore led to believe that they might be referable to the abnormal position of the testicle. Under this conviction I determined upon producing, if possible, its descent into the scrotum. I had a truss constructed to press upon the inguinal canal above the testicle, furnished with a strap which passed under the thigh, and kept the apparatus perfectly fixed. At the same time I attached the lower part of the scrotum to the thigh by strips of adhesive plaister, and thus maintained the gubernaculum in constant tension, tending through its instrumentality to draw the testicle into its normal position. This treatment proved perfectly successful; for in the course of a week the testicle had passed through the external ring, and from that moment every symptom of stone ceased.

A boy, aged 15, was admitted into Stephen's ward, suffering from all the symptoms of stone in the bladder, with the exception of bloody urine; he was frequently sounded, but a calculus could never be detected. From the experience obtained in the case just recited, I was induced to make an examination, to ascertain whether the testicles had descended, and found that the left was not in its natural position, but remained fixed in the inguinal canal.

I adopted a system of treatment in this case similar to that I have above described, with the exception that I had an apparatus constructed by Mr. Bigg, for the purpose of keeping up the tension upon the gubernaculum by means of a spring; and in the course of a very short time the testicle descended into the scrotum, and, as in the former case, all the symptoms of stone immediately subsided. I have frequently witnessed most anomalous symptoms of urinary affections concomitant with non-descended testicle; nor can this circumstance be considered surprising, when we remember that the renal and spermatic plexus of nerves derive their source from the same roots, and are equally liable to disturbance from the same cause of irritation.

Operation of sounding.—These cases sufficiently prove that the mere circumstance of a patient suffering from the symptoms of stone does not demonstrate its existence in the bladder; hence arises the necessity for applying the test of sounding. This operation consists in passing into the bladder the instrument termed a sound, and by a gentle searching motion, exploring the whole of the interior of the viscus. If a stone be present, it is in general easily detected, and can, not only be felt, but may also be struck, so that the sound of the blow can be distinctly heard by the operator and those standing around him. A stone may, however, escape detection by the sound, either on account of being situated behind the prostate, when that gland is enlarged, or from being lodged above the pubes, or, perhaps, if it be very small, from its becoming enveloped in the folds of the bladder. In the first case, the stone may easily be discovered by passing the finger up the rectum, so as to raise it from its situation behind the prostate gland; in the second, it may be displaced by pressure upon the pubes; while in the third, it may be discovered by injecting the bladder with tepid water, so as to distend it and unfold its rugæ, leaving the calculus exposed to detection by the sound. Calculi are also said to be sometimes contained in sacculi of the bladder which are produced by a sort of hernia of the mucous membrane between the fibres of its muscular coat. This condition is indicated by the circumstance of the stone, when discovered by the sound, being always found in exactly the same position.

When the detection of a stone is attended by any of these difficulties, its removal by the operations of lithotomy or lithotrity is certain to be proportionately impeded; and, therefore, under such circumstances, the surgeon should keep the patient some time under his observation before he performs the operation, in order that he may become completely master of the peculiarities of the case, and be the better prepared to meet the difficulties likely to present themselves.

By the operation of sounding we not only ascertain the presence of a stone, but may also form a pretty accurate opinion of its size, shape, weight, and hardness; and the knowledge of these physical properties will probably serve to regulate the medical treatment, as well as the mode of proceeding with the operation, particularly as to whether it be advisable to adopt that of lithotrity or of lithotomy. At all events, when a stone is discovered beyond doubt to be present in the bladder, a surgical operation offers the only means of permanent relief; but before we proceed to this extreme measure, it is proper to consider carefully the concomitant circumstances of the case, as indicative of a favourable or unfavourable result,—we should, indeed, technically speaking, form the prognosis.

In calculating the probability of a successful issue to the operation, the age, constitution, and previous habits of the patient, must be taken into serious account, as well as the nature and extent of the local affection. If the patient be advanced in years, his constitution broken by excess, or impaired by want or anxiety, or if he be naturally of a cachectic habit, the prognosis should be determined with great caution, and generally speaking, under such circumstances, it would be extremely unfavourable, and, where the symptoms are aggravated, perhaps hopeless. Local circumstances must also influence the judgment as to the advisability of submitting a patient to the operation: for instance, the bladder may be thickened, perhaps ulcerated, and this may be attended by an albuminous state of the urine. In such cases, the first care of the surgeon must be the general health of the patient, which should be restored by the administration of appropriate remedies, before the removal of the stone is ventured on. Albuminous urine must not, however, always be considered a proof of organic change in the kidney. I have, indeed, scarcely ever tested the urine of a subject of stone in the bladder, without detecting the presence of albumen; and if the patient be young, of good constitution, without any other indication of organic disease of the kidnies, liver, or lungs, and the bladder itself is also sound, and if in addition he be neither of an irritable temperament nor scrofulous diathesis, notwithstanding the presence of albumen in the urine the prognosis may be favourable, and a successful termination to the operation reasonably expected.

Success in the operation of lithotomy depends almost entirely upon the judgment of the surgeon in distinguishing the circumstances under which it becomes advisable to perform the operation, or at once reject the case as unsuitable to it. Wherever there is much functional disturbance or organic disease, the operation ought, in my opinion, not to be attempted, as failure brings it into disrepute, and renders many on whom it might be safely performed fearful of the result; thus inflicting an injury upon the science of surgery, and tending to deprive those who are suffering from the disease of the only means of obtaining permanent relief.

Advanced age does not appear much to influence the result of the operation for stone. I have myself performed it upon infants fourteen months old, and upon an adult of the age of eighty, with equal success. At the same time, children certainly support the operation with least constitutional disturbance, and at any period of life before puberty the result is usually successful. Aged patients also appear to suffer less than persons in mid-life; and indeed, so far as my experience goes, I am inclined to believe that the danger in lithotomy is in proportion to the vigour of the procreative energies.

The size of calculi varies very considerably, and materially influences the means to be employed for their removal, as well as the result of the operation. The danger in the operation is certainly increased according to the magnitude of the stone, which is sometimes so large as to preclude the possibility of its extraction. There is a calculus in the museum of the College of Surgeons weighing 44 ounces; such a mass could never have been extracted by operation. In Trinity College Library, Cambridge, there is a calculus weighing 32 ounces; and there is also one mentioned in Pepys' Diary, p. 215, vol. ii., which was removed after death from the bladder of Sir Thomas Adams, alderman of London, weighing 25 ounces; and, what is the most extraordinary part of this history, during his life he never complained of any symptom of stone, and died of another complaint.

I once saw the operation of lithotomy performed by Sir Astley Cooper in a case in which he removed a calculus weighing 16 ounces: the operation occupied nearly two hours, and the patient died four or five hours after it was completed. So large a stone should never be attempted to be removed whole, but when its existence is suspected, an instrument should be prepared beforehand to crush and break it down into small portions after the bladder has been opened. The largest stone I have ever removed weighed 6½ ounces, and the patient recovered from the operation. It is worthy of remark, that the symptoms of stone in the bladder are not generally severe in proportion to the size of the calculus; of this I have had frequent examples in my own practice. In September, 1834, I was sent for by Mr. Harrison, of Hoddesdon, Herts, to visit a patient who was suffering from retention of urine. Mr. Harrison had attempted to draw off the water, but could not succeed in introducing the catheter into the bladder; I tried, but met with the same insuperable impediment to the passing of the instrument; which I found to proceed from a calculus impacted in the urethra. I at once proposed to remove it, and as the patient consented, I performed the operation, cutting down upon the stone, in perineo, just below the scrotum. The stone was about the size of an almond, and was easily removed. I passed a catheter into the bladder to draw off the water, and then, to my great astonishment, discovered a very large calculus, the existence of which was totally unexpected, as the patient, a young farmer, had been working in the hay-field as usual up to the time of being attacked with retention of urine, suffering no inconvenience even in the heavy labour of "pitching" the hay into the waggon. A week after removing the calculus from the urethra, I saw the patient again; he was suffering considerable constitutional disturbance, arising apparently from the irritation produced by the constant flow of urine through the wound, excoriating the scrotum and perineum. I advised him to come into Guy's Hospital, which he did. After he was admitted, I passed an elastic gum catheter, and kept it in the bladder, as urine was constantly dribbling from him. In the course of a few days, however, he was attacked by fever, and died a week from the time of his entering the hospital. In the post-mortem examination, a stone, weighing nine and a half ounces, was found in his bladder; it physically resembled the smaller calculus which I had previously removed from the urethra, and which, on being analysed, was found to consist chiefly of carbonate of lime, there being merely a trace of the phosphate present. The larger stone was not subjected to analysis, but it, as well as the bladder, is preserved in the museum at Guy's. Another case of calculus of extraordinary size, unattended by constitutional irritation, was related to me by Dr. Stephan, of Wurtzburg. A patient was admitted into the hospital of that town, complaining of the symptoms of catarrhus vesicæ, unattended by any of the symptoms of calculus; but on passing a catheter, for the purpose of washing out the bladder, a large stone was discovered. The lateral operation was performed, but the size of the stone was so great that it could not be removed by the opening. As soon as the patient was sufficiently recovered, a second attempt was made, the recto-vesical section being adopted; but this was equally unsuccessful with respect to the removal of the stone, and it proved fatal to the patient. When the body was examined after death, it was discovered that the stone was too large to pass through the inferior opening of the pelvis, and indeed, after the skeleton was prepared, the stone could not be drawn through. The pelvis and the stone are preserved together in the museum of the hospital at Wurtzburg.

I have often felt surprise at the comparatively slight suffering experienced by patients when the stone is of the kind termed the mulberry calculus, which, from the excessive roughness and irregularity of the surface, we should expect would be productive of great pain. On the contrary, however, it seems to afford much less inconvenience and constitutional disturbance than is experienced when the stone is composed of the triple phosphate. The number of calculi, if small, as Sir Astley Cooper has remarked, does not seem to add much to the danger of the operation of lithotomy, as it merely becomes necessary to repeat the introduction of the forceps, without the employment of additional force. In one case Sir Astley Cooper successfully removed fifteen calculi; but I have myself never met with more than six in the same patient. When more than one stone is present in the bladder, their surfaces are rendered polished by rubbing against each other, so that wherever a very smooth stone is removed in the operation of lithotomy, a careful examination should always be made to ascertain if others be not present.

LECTURE XLVII.

CONTINUATION OF STONE IN THE BLADDER.

Choice of means for the removal of a stone from the bladder—Lithontriptics generally inefficient—Lithotrity preferable in some cases to lithotomy—Circumstances under which it may be adopted—Preparation of the patient—The operation—Necessary precautions—After-treatment—A portion of the broken stone sometimes lodges in the urethra—Removal by an instrument, by cutting—Probable effect—Best means of healing the wound—Difficulties that may arise in the operation of lithotrity—Use of scoop lithotrite—Seizing the calculus with the lithotrite—Operation of lithotrity—Easy of performance—Case—Circumstances in which lithotomy ought to be employed instead of lithotrity—Preparatory treatment of the patient—Varieties of the operation—High operation—Cases—Lateral operation—Instruments—Mr. Key's straight staff—Necessity for mature reflection before deciding upon performing this operation.

After a due consideration of all the peculiarities of a case of stone in the bladder, both with reference to the constitution of the patient and concomitant local circumstances, the surgeon is called upon to decide, firstly, as to the expediency of attempting the removal of the stone by operation; and secondly, whether the operation of lithotrity, or that of lithotomy, ought to be preferred; or whether, instead of a surgical operation, it be advisable to endeavour to effect the solution of the stone within the bladder, by the employment of menstrua technically termed lithontriptics. In the use of the latter the object must be either the entire solution of the calculus, or its disintegration, so that it may be carried off with the urine in the form of detritus; many different agents have been administered for these purposes, in the form of internal remedies, and as injections into the bladder.

I appeal to experience as to the result of the trials which have been made with lithontriptics, and believe I may venture to say, that we are not at present possessed of any medicine capable of dissolving, with safety to the patient, a calculus already formed, either in the kidney or bladder; but although such a remedy has not yet been discovered, we ought not to despair of the accomplishment of this desirable object, remembering the great benefit that has already been derived from the application of the science of chemistry to the treatment of stone. Neither can much be said for the efficacy of injections for the cure of stone: for as yet we have no evidence of their power to remove a calculus when once formed; although, like medicines taken internally, they may sometimes relieve the suffering produced by a stone in the bladder. Dietetic observances, alkaline remedies with opiates, and diluent drinks with injection of the bladder, may all, or each, afford relief; but no hopes can be justly entertained of their producing a cure of the disease. Our attention must next be devoted to the consideration of the circumstances under which the operation of breaking down the stone, technically termed lithotrity, is to be preferred to the operation of lithotomy. This subject has occupied the attention of many eminent surgeons, and lengthened dissertations have been the result. I think, however, that very few words need be said on the subject. There can be no doubt that there are cases in which lithotrity is infinitely preferable to lithotomy; and it is equally true, that there are many others to which it is wholly inapplicable: nor are the means of judging between these two conditions at all difficult; and the circumstances which should regulate the choice are few, and easily appreciated. In cases of small stone, when the bladder is capable of containing about six ounces of water for a considerable time, and the urethra is of normal size, I believe the operation of lithotrity may always be recommended; and not even a moderately diseased state of the kidnies need prohibit this operation, although in lithotomy the same extent of disease would involve a considerable increase of danger: indeed, in appropriate cases, the operation of crushing the stone is comparatively so simple, that there is a just hope of the morbid condition of the kidnies becoming improved after the removal of the calculus, unless they have undergone some organic change; and even then improvement may be expected from the removal of so great a source of irritation.

The operation of lithotrity.—A patient requires but little preparation for the operation of lithotrity; the principal circumstance to be ascertained is, whether the bladder is capable of retaining a sufficient quantity of fluid to keep it in a fit state of distention to allow the lithotrite to act without danger of injury to the coats of the organ. If the bladder be irritable, the operation should not be immediately performed; but remedies first administered to alleviate this symptom; and tepid water should be daily injected into the bladder, gradually increasing the quantity and period of its retention until the patient is capable of holding six ounces long enough for the performance of the operation, which may then be considered safe, no further preparatory treatment being required beyond merely opening the bowels freely. The operation being decided on, the most convenient position in which the patient can be placed is sitting in a semi-recumbent posture upon the foot of a low bed (his back being supported by the mattress doubled behind him), and his feet resting upon two chairs, sufficiently separated to allow the operator to sit conveniently between them. The bladder should next be injected with about six ounces of warm water (92°), and the lithotrite then carefully and gently passed into the bladder. This is not effected by the same motion of the hand as that by which the sound or catheter is introduced, but being rather pushed or pressed onwards, the penis being drawn forwards upon the instrument. While the lithotrite is being passed, the approximation of the blades should be secured by turning the screw to its fullest extent; a precaution which is not always taken, but which is important, as it prevents the possibility of the blades separating during their passage through the urethra, and the consequent liability of injury to its membrane. As soon as the instrument has fully entered the bladder, the screw should be turned to release the blades from its influence, and they should then be separated, so as to be ready to grasp the stone: if at this time any water makes its escape by the sides of the lithotrite, an assistant should press the urethra against it to prevent the flow. The operator now standing up before the patient, presses the convexity at the end of the lithotrite with considerable firmness upon the inferior region of the bladder, so as to render that part most depending; and giving the lithotrite a gentle tap, the stone naturally falls into the cavity, and being immediately felt by the operator, is easily grasped by closing the blades: by the action of the screw, it is now to be broken down, and piece after piece seized until crushed into fragments sufficiently small to pass as detritus through the urethra. As to the number of times the stone may be seized, no definite directions can be given; this must depend upon the temperament of the patient, and the degree of suffering produced by the operation: and it should be remembered that as soon as the patient begins to complain of increase of pain, the operation or sitting should be terminated. I have learned by experience that, instead of attempting to crush as much as possible at the first, or any subsequent operation, it is better to be satisfied with apparently less progress, and to avoid giving pain, and otherwise distressing the patient; for I am sure that the frequent repetition of the operation carefully conducted does much less harm than one or two sittings in which the surgeon perseveres in his attempts to seize and crush the fragments, without regard to the suffering and exhaustion of the patient. After the operation the bladder should be washed out by injecting it with warm water, which produces a soothing influence upon the coats of the bladder. The patient should not be allowed to walk or move about after the operation, but should be immediately put to bed, and a dose of opium in weak warm brandy-and-water administered, to check the liability to rigor, as well as to overcome the irritability of the bladder, necessarily excited by the irritation to which it had been subjected. The prevention of the rigor is a matter of the greatest importance; for if it be not checked at first, by the opium, there is not only the ill effect of the one attack to overcome, but it seems as if the patient became subject to its recurrence; while, on the contrary, if it be stopped at first, he seems to be but little liable to it subsequently. This fact was first mentioned to me by my friend Sir Benjamin Brodie; and I am from experience thoroughly convinced of the accuracy of his judgment on this as on every other surgical subject. For the first two or three days after the operation, the patient should be kept in bed, and should pass his water in the recumbent posture, not attempting to force the fragments away with his urine until the irritability of the bladder has ceased; he should then micturate in the erect posture, or even lean forwards, so as to direct the broken portions of stone towards the urethra. If a fragment becomes lodged in the passage, its extrication should not be immediately attempted, but a dose of opium given, and the patient kept in bed to await the chance of the stone passing with the next flow of urine. Should this not happen, and the patient still retain the power to pass the urine, the surgeon should not yet interfere; but if the urine cannot escape, the fragment of stone must be removed by mechanical means. For this purpose, various instruments have been invented, such as forceps of different forms; but the best contrivance I have seen, and which I have found upon one or two occasions perfectly efficient, is a French instrument, made in the form of a straight staff, with a joint at the extreme end and a screw at the top. This instrument is of small size, as it is intended to pass beyond the foreign body in the urethra; when thus placed, the screw is turned, and, acting upon the little joint at the extremity, brings it to a right angle with the shaft of the staff; then, upon gently withdrawing the instrument, the stone is necessarily brought up with it. Sometimes, however, these means may fail; and then it will be requisite to cut the portion of the calculus out of the part in which it is fixed. Fortunately this necessity occurs most frequently at the orifice of the urethra, which is the narrowest part of the canal, and the operation is a matter of no danger as to result. Not so, however, when the stone becomes impacted lower down; for although there may exist little obstacle to its removal, it may prove afterwards very difficult to heal the opening, in which case a fistulous passage, termed a traumatic hypospadius, may permanently remain. Before, therefore, the surgeon proceeds to cut out a fragment which is impacted low down in the urethra, every means should be attempted to effect its passage with the urine. Opiates, warm bath, and tartarized antimony, should be exhibited; and if these remedies fail, it should, if possible, be pushed back into the bladder, in order that it may be further broken down by the lithotrite. If, however, it be found impossible to push the fragment back into the bladder, then, and not till then, should it be cut down upon, and removed from the urethra; and when it becomes actually necessary to cut into the perineum to remove the calculus, I believe the best method of healing the opening, or rather to facilitate its healing, is to use the catheter for the first week or ten days, whenever the patient requires to pass his water, so that no urine may pass through the wound; and this plan I think preferable to that of leaving an instrument constantly in the bladder, as the urine has a tendency to escape between the urethra and the catheter, and to produce great irritation.

It must not be supposed, from this description of the operation of lithotrity, that it is without its difficulties. This is not the case; and these difficulties may arise from many different sources; one of the most frequent of these is, perhaps, a congenital narrowness of the meatus of the urethra, which is sometimes so contracted at its orifice as not to admit of the entrance of the lithotrite. This may generally be remedied by enlarging the opening by means of a probe-pointed bistoury; for the contraction does not often extend far into the canal, which, through the remainder of its length, is usually of the normal size. Where stricture of the urethra is present, a great obstacle is also opposed to the introduction of the lithotrite; and before it can be employed, the obstruction must be overcome by the use of instruments: indeed, if the stricture cannot be sufficiently removed so that the urethra is restored to its natural capacity, the operation of lithotomy must be substituted for that of lithotrity.

The dread with which a patient naturally anticipates a surgical operation, be it even of a comparatively slight character, generally produces a degree of excitement, in consequence of which the bladder is often rendered too irritable to retain sufficient water for its proper distention during the operation, although on the occasion of former trials it was found perfectly competent to do so. Thirty drops of laudanum should therefore be given to the patient about an hour before the operation; and a suppository inserted into the rectum will also be found to produce a very favourable effect. Should, however, the irritability of the bladder be so great as not to be controlled by these means, it is better to postpone the operation until, by the employment of constitutional remedies, the patient can be brought into a more suitable condition.

Another difficulty, but of a mechanical character, sometimes arises in the use of the instrument termed the "scoop lithotrite," which is intended to bring away portions of detritus after the stone has been crushed. This instrument can sometimes only be withdrawn with considerable difficulty, in consequence of the accumulation of calculous matter between its blades; and I have in one instance known the instrument to be broken within the bladder in attempting to screw it up sufficiently close to admit of its passage through the urethra; for my own part I condemn the use of the scoop lithotrite, unless imperatively demanded, as I see no advantage in the forcible removal of the broken-down matter of the stone: for the detritus, when the portions are small enough to be brought away by the scoop, will generally pass off with the urine; and, moreover, the most urgent symptoms which I have ever witnessed as the result of the operation of lithotrity have been in those cases in which the scoop lithotrite was employed to withdraw the detritus; for the danger seems to be in proportion to the stretching and laceration of the prostate gland and urethra, and not to the injury sustained by the bladder itself. Sometimes, however, it is impossible to avoid the use of this instrument, as in the following case:—

A few weeks ago I performed the operation of lithotrity on a patient, and found no difficulty in repeatedly seizing and completely crushing the stone. A very small quantity of detritus passed away, however, after the operation,—so little, indeed, as not by any means to correspond with the size of the stone; and I was therefore compelled to employ the scoop. This was followed by a profuse secretion of ropy mucus, which passed off readily with the urine. Observing one day, in the glass vessel in which the mucus was kept, a very considerable sediment, it occurred to me that a large portion of the detritus was held in suspension, and possibly partly in a state of solution. Upon this supposition, I desired the mucus to be preserved, and, having collected a sufficient quantity, I requested my friend Mr. Nicholson, of the Royal Chemical College, to make an analysis of it. The following was the result of the experiment:—"The amount of mucus, after separation from the urine, and being perfectly washed and dried, weighed 62 grains. The amount of inorganic matter, after incineration, weighed 19·5 grains. This was found to consist of phosphate of lime, phosphate of magnesia, and a small quantity of carbonate of lime, which last was produced from the oxalate during the ignition." In pure mucus there is scarcely 2 per cent. of inorganic matter, while in this case there was very nearly 30 per cent. The circumstance of this large quantity of the constituents of a broken-down calculus being held in suspension by mucus is a most important feature in connexion with the operation of lithotrity, as the surgeon will learn that, even where the detritus passes with difficulty in its coarser form, the impalpable particles are readily removed by this effort of nature. It is worthy of remark, in this case, that no fragments of stone were contained in the mucus, nor have I since been able to detect any remaining in the bladder, although the strictest examination has been instituted. A question, however, still remains undecided—whether the detritus of any other species of calculus besides that of bone-earth is capable of being thus suspended in mucus? I trust the recital of this case will lead the attention of the profession to the subject, so as to excite further investigation.

A second case, very similar to the above, has since occurred to me. A gentleman, 35 years of age, from Nottinghamshire, was sent to me by Dr. Golding Bird for examination. I readily discovered a calculus in his bladder; and, after considering the circumstances of the case, proposed the operation of lithotrity. I performed the operation the third day after I first examined the patient, Dr. Golding Bird being present at the time. The stone was very easily seized; and, as the patient manifested no signs of irritability, I several times seized and crushed the fragments. After the operation, I gave him thirty drops of laudanum: he passed a quiet night; and on my visit next day, I was astonished to find that upwards of thirty grains of detritus had been already passed. By the end of the week he had passed 130 grains, and was so free from every symptom of stone, that I was almost led to believe that the whole of the calculus had been removed; and, upon sounding, I could not detect the presence of the smallest portion. Being aware, however, that the lithotrite would often detect that which may elude the sound, I injected four ounces of water into the bladder, and passed the smaller scoop lithotrite, when I immediately detected a portion of stone, which I seized and crushed, withdrawing the detritus between the blades of the instrument. The fragments thus removed weighed ten grains; and as the withdrawal of the lithotrite created some irritation, I relinquished all further examination for the time. Four days afterwards, in washing out the bladder, I again detected a portion of stone, passed a large lithotrite, and immediately seized a piece of stone about the size of a bean; this I easily crushed as before; and on that evening about fifteen grains of detritus passed. Since that time I have not been able to detect the presence of any portion of stone. All the symptoms have completely subsided, and the patient appears to be restored to perfect health.

Notwithstanding the freedom with which the detritus passed from this patient's bladder, I was surprised to find that a very large quantity of mucus was mixed with his urine, which, from the result of the examination of the mucus passed in the last case, I had not anticipated, believing that the secretion in the former instance had resulted from the detention of the detritus. I therefore sent this mucus to the College of Chemistry, as before, and, to my astonishment, found that the analysis showed the existence of the same per-centage of bone-earth as in the former case.

It is a general belief that the greatest difficulty in the use of the lithotrite consists in seizing the stone with the blades of the instrument; but in my own experience—and I have operated in upwards of twenty cases—I have never met with this difficulty, and have, indeed, frequently been able, by the lithotrite, to discover and grasp a fragment of stone which had completely eluded detection by the sound.

Although there are many difficulties that occasionally present themselves in the use of the lithotrite, in appropriate cases the operation is not only an easy one, but is often productive of such admirable results as to give lithotrity a claim to be considered one of the greatest inventions of modern surgery. In three or four of the cases I have had, one operation has been sufficient to effect a permanent cure; but the best instance was one sent to me by Mr. Parrot of Clapham, in which the patient was suffering from the most urgent symptoms, and was completely cured at one "sitting." After the stone was crushed, a drachm of detritus passed away, and no symptom of stone has ever returned.

Although circumstances may arise that may render the operation of lithotrity unsafe, it does not necessarily follow that that of lithotomy should be performed; for, as I have already mentioned, it is the duty of the surgeon first fully to ascertain that the general health of the patient renders him fit to be subjected to such an ordeal. In the first place, I should say the state of the urine should be strictly investigated; and if it be found, by the application of heat or nitric acid, to contain a large quantity of albumen, free from the colouring principle of the blood, the patient must be considered totally unfit, at least at the time, to be exposed to the hazard of the operation. The state of the heart and lungs, of the abdominal viscera, and more especially of the liver, should each be the object of close investigation ;—I say especially of the liver, on account of the liability of that organ to disease, and not unfrequently to a fatty degeneration, concomitant with which the vital powers are invariably much diminished, and the subject of the complaint rendered incapable of sustaining the reparative efforts of the constitution. Such cases are not, however, to be despaired of: medicinal means should be employed, change of air and scene recommended to the patient, and he will probably be restored to a condition in which he may be able to undergo the operation with reasonable prospect of a successful result. When none of these cogent reasons exist for delaying the operation of lithotomy, there is a previous preparation which the patient ought invariably to be submitted to, and for which no general plan can be laid down, as it must in every instance be regulated by the constitutional peculiarities of the individual. Thus, in plethoric habits, it may be necessary to have recourse to depletion, and both blood-letting and purging may be requisite; indeed, I have generally found them more efficacious when conjointly employed than when either has alone been resorted to. In cases of great obesity, it may also be necessary to reduce a patient before the operation can be safely performed; and my friend, Mr. Green, some years ago had a patient from Manchester, who, when he first consulted him, weighed twenty-six stone: he was reduced, by strict dietetic discipline, to nineteen stone, and was then successfully subjected to the operation of lithotomy.

It is also highly desirable to prepare the mind of the patient, as well as his body, for what he has to undergo; and for this purpose it is proper to describe to him the position in which he will be placed during the operation,—for I have not unfrequently seen a patient, particularly in the better class of life, who had heroically made up his mind to submit to the operation, and walked firmly to the table, completely give way on learning the constrained position in which he was to be placed. It is also of great use to prevail on the patient, for a few days before the operation, to remain occasionally for five or ten minutes in the attitude of grasping the soles of his feet, in order to accustom the muscle to so unusual a position; and this not only diminishes the terror, but also the distress, which would otherwise produce a great increase of excitement during the operation.

The night previous to the operation, a purgative should be administered, and in the morning an enema given, for the purpose of securing complete evacuation of the rectum. In persons of very irritable habits, it is also advisable, after the action caused by the enema has ceased, to inject about thirty drops of laudanum, in an ounce of gruel, into the bowel, with the view of lessening the muscular irritability of the parts, and also to produce a beneficial sedative effect after the operation has been performed. Let me here suggest, that the surgeon himself should be certain that all these preparations have been effected before the appointed period for the operation, so that when the time arrives the patient's mind may not be kept in agitation by unnecessary delay.

Operation of lithotomy.—In lithotomy very various operations have been proposed, and to a certain extent adopted at different periods, and a multitude of instruments of different kinds have been employed; but I shall content myself with the description of what is termed the lateral operation, which is now almost invariably performed in this country, in consequence of its affording the most direct and safe passage into the bladder.

The high operation, nevertheless, demands some brief consideration, although, in my opinion, it ought never to be adopted, excepting where the prostate gland is so much enlarged, or the pelvis deformed, as to render the lateral operation inexpedient. Many surgeons contend, however, that a larger stone may be removed by opening the bladder above the pubes, than by the lateral section. I doubt the correctness of this view, and believe that such an opinion is generally founded upon the observation, that the bladder can be opened with greater facility in the pubic region, in cases of distention from retained urine; but in cases of stone, as the bladder is thickened and contracted, deeply placed in the pelvis, and covered by peritoneum, it can only be opened with considerable difficulty; and it is almost impossible to remove a large stone from it without injury to its serous covering. I once saw the high operation performed by Sir Everard Home, and a most difficult and tedious operation it was: after he had cut down through the parietes of the abdomen, above the pubes, he was obliged to make an opening in the perineum, and pass an instrument into the bladder from below, to enable him to open the bladder above the pubes. After much difficulty, a calculus was removed; but the patient died, in consequence of this complicated operation, a few hours after its completion.

A friend of mine, a few years since, was present at the performance of the high operation of lithotomy, by M. Civiale, of Paris.

In making the first incision through the parietes of the abdomen, he wounded the peritoneum, which led to the protrusion of the small intestines. He returned these into the abdomen, and continued his operation, and ultimately succeeded in extracting a stone. The patient was put to bed, and M. Civiale, on subsequent consideration, dreading the liability to extravasation of urine into the peritoneum, determined upon laying open the bladder through the perineum. He effected this, and so completely succeeded in preventing the result he feared, that the patient ultimately recovered.

Notwithstanding this case, I remain as much as ever disposed to repudiate the propriety of the high operation, although I cannot too much extol the acumen shown by the above eminent surgeon, in the means which he adopted to obviate the danger of extravasation of urine caused by his mishap in the commencement of the operation.

As to the instruments to be employed in lithotomy, there are but few that are not applicable, if directed by the hand of an anatomist and surgeon; although, after considerable experience, I must, in justice to Mr. Key, express my preference to the straight staff; but it must be in the hands of those who can appreciate its value, and who know how to avail themselves of the advantages it affords. The operation of lithotomy should never be undertaken without maturely considering every separate step necessary to its completion, and not at once look forward merely to the ultimate object—the extraction of the stone. Nor, in contemplating each step, should the facilities alone be considered; but every difficulty which can possibly occur, dwelt on, and the means of obviating it anticipated: indeed, as much, or perhaps more, depends upon the discipline of the operator's mind, than upon the mere dexterity of his hand; for it can hardly happen that the manipulation should be dexterous, when the instruments are not directed by judgment and coolness in the operator.

LECTURE XLVIII.

CONTINUATION OF STONE IN THE BLADDER.

Division of the operation of lithotomy into four steps—Position in which the patient must be placed—Difficulties that may arise from deformity in the patient—Case—Introduction of the staff—First step of the operation, viz., laying open the perineum—Second step, laying open the pelvis—Chief points of consideration—Danger of wounding the artery of the bulb of the urethra—Mode of stopping the hæmorrhage—Third step, opening the bladder—Fourth step, removal of the stone by the forceps—Difficultes arising from the situation, form, or size, of the stone—Friability of calculi—Removal of broken portions by the scoop—Necessity for extreme gentleness in the manipulation—Difficulty in seizing the stone by the forceps—Treatment of the patient after the operation—Case—the operation sometimes requires to be repeated—Cases—Treatment after operation.

The operation of lithotomy may be divided into the following steps :—

Laying open the perineum.
Laying open the pelvis.
Laying open the bladder.
Extracting the stone.

In the operation, the patient should be placed upon a table about two feet four inches in height, and secured by ligatures confining the palms of the hands to the soles of the feet; in adults, another ligature should likewise be passed under the hams and fastened at the back of the neck. An assistant on each side takes hold of the knees, so as to separate the legs, using at the same time a certain degree of downward pressure to keep the pelvis well fixed upon the table. A difficulty may occur in confining the patient in this position, which is essential to afford the necessary facility to the operator, in consequence of deformity in the patient, such as anchylosis of the hip or knee. I have myself had to perform the operation of lithotomy under these disadvantageous circumstances. Some years ago, I was sent for to Wangford, in Suffolk, to remove a stone from a patient who had an anchylosed hip. In this case, the sound leg was tied up in the usual way, while the anchylosed limb was merely supported by the hand of an assistant. Before I commenced the operation I expected considerable difficulty, from the impossibility of abducting the diseased limb, and met with some impediment in cutting into the membranous part of the urethra: the unusual position, however, offered no other inconvenience in the further steps of the operation, and rather a large stone was removed in about two minutes. My colleague, Mr. Hilton, was present at this operation, which proved quite successful. I have, in two other instances, operated under circumstances where, from former disease of the knee-joint, patients could not be secured in the usual way; but in these cases the integrity of the hip admitted of the full exposure of the perineum, therefore no great amount of difficulty was encountered. In very fat people it is frequently necessary to modify the method of securing the patient, in consequence of their being unable to grasp the soles of their feet, and under these circumstances the wrists must be secured by ligatures above the ankles. In some cases it may be necessary, where there is difficulty in passing the staff, to do so before the patient is bound, but otherwise it is best to confine him first in the proper position, as the instrument is liable to be struck by the assistant while securing the patient. In thus arranging the patient, the body should be disposed in as easy a position as possible, and the shoulders should be raised by pillows placed so as to afford a general and equable support to the back.

The preparations being completed, the staff should be introduced, and when the stone is felt, the instrument is given to an assistant to hold firmly with his right hand, he standing on the left side of the patient. It must be remarked that if the straight staff be used, it cannot be brought to a right angle with the horizon, as the curved staff can, but only to an angle of about 45°. It should not be raised beyond this, as its point is then liable to be drawn out of the bladder.

The *first step* of the operation consists in laying open the perineum: this is effected by an incision through the integuments, fat, and superficial fascia. The incision commences a little to the left side of the raphé, and about a finger's breadth below the point of junction of the raphé of the perineum and that of the scrotum, and is continued downwards and obliquely outwards to a point midway between the centre of the verge of the anus and the tuberosity of the ischium. A triangular space is thus laid open, bounded above by the membranous part of the urethra; below by the transverse muscle and artery of the perineum; on the inner side, and in the mesian line, by the accelerator urinæ muscle; and on the outer by the erector penis. Nothing untoward can be expected to occur in the performance of this step, unless a fistulous opening or abscess be exposed, or sufficient hæmorrhage occur, from the necessary division of some of the branches of the superficial perineal artery, to require a ligature to arrest it.

The *second step* consists in laying open the pelvis. In this the forefinger of the left hand is passed to sufficient depth in the upper part of the wound to feel the groove of the staff through the membranous part of the urethra. Into this groove the point of the knife is to be introduced, so as to get beyond that portion of the deep fascia termed the triangular ligament of the pubes; the knife is then carried downwards in the same direction as in the first incision; and thus the whole length of the deep fascia of the perineum is divided, together with the transverse muscles and artery of the perineum, and some fibres of the accelerator urinæ.

The principal point to be observed here is the opening of the urethra at its membranous part, avoiding as much as possible the bulb and its large artery. It is also in making this incision that the rectum is liable to be wounded: but this may always be avoided by the oblique direction of the incision towards the tuberosity of the ischium, as well as by the precaution of having the bowel perfectly emptied before commencing the operation. Many surgeons defer opening the urethra until they proceed to cut into the bladder, but I prefer commencing the second step as above directed; first, because it affords a precise point from which to commence the second incision; and, secondly, because it secures the complete division of the deep fascia, a portion of which may otherwise be left undivided, requiring, probably, a subsequent further division, as it may offer an impediment to the extraction of the stone. Notwithstanding every precaution, the artery of the bulb is sometimes wounded, and, from the depth of its situation, and its tendency to retract, it is very difficult to secure; indeed, much time should not be lost in the attempt, but the operation finished, and then, by pressure, the bleeding may generally be stopped. My friend, Mr. Travers, had, some years ago, great difficulty in arresting bleeding from the artery of the bulb; he succeeded, however, by the ingenious and scientific expedient of placing a hard compress of cork under his patient, in such a situation that the weight of the body compressed the internal pudic artery between the cork and the spinous process of the ischium, so as to completely check the hæmorrhage. The precise point at which the compress should be placed may be ascertained by drawing a line from the upper part of the trochanter major to the articulation of the os coccygis with the sacrum. At the junction of the inner with the middle third of this line is situated the spinous process of the ischium; the internal pudic artery passes immediately over it. The necessity for placing the patient, under these circumstances, upon a hard mattress, is sufficiently obvious.

Should the transverse artery of the perineum occasion a troublesome hæmorrhage, as it sometimes does after its necessary division in this step of the operation, it may be readily secured, from its comparatively superficial situation.

Some difficulty may occur, in the second step of the operation, in opening the membranous portion of the urethra, particularly to surgeons who have been in the habit of using the curved staff; as, with the straight one the depth appears much greater, from the absence of the usual curve of the instrument, which presses towards the perineum, and brings the urethra forward; but, in my opinion, this apparent facility is detrimental to the operation; and its absence, in truth, constitutes one of the great advantages to be derived from the use of the straight staff: for the bulb, not being pushed forward, is more easily avoided than when the curved staff is employed. This is an object of the greatest importance, not only from the circumstance of the artery of the bulb being left undivided, but also on account of the more direct opening which is made through the perineum into the bladder.

The *third step* consists in the division of the whole length of the membranous portion of the urethra and of the prostate gland, for the purpose of laying open the bladder. With this object the surgeon again passes the knife into the groove of the staff, as at the commencement of the second step; and having ascertained that the knife is in the groove, without *any interposing* tissue, he takes the staff from the assistant with his left hand, and depresses the handle until he brings it parallel with the knife and the long axis of the pelvis; thus acquiring a direct passage for the knife into the bladder. To accomplish the opening of the bladder, the groove of the staff and the edge of the knife must be simultaneously directed towards the left side of the patient, at such an angle that the passing of the knife will form an incision in a direction corresponding to those already made. If a cutting gorget be used instead of the knife, its edge should, in like manner, be laterally directed. In passing the knife along the staff into the bladder, the surgeon can regulate at will the size of the opening, on the entrance of the knife, by the angle at which he holds it with the staff; or if the knife be passed parallel with the staff, he has the power of enlarging the opening as the knife is withdrawn. The parts divided in this section are, the urethra, prostate gland, and the fibres of Wilson's muscle on the left side. By far the most important point to be attended to in making this section is, not completely to divide the left lobe of the prostate,—for if the fascial covering of the gland be cut through, the urine extravasates into the cavity of the pelvis, and this, there can be no doubt, is the most frequent cause of death after the operation of lithotomy. In fact, although I have stated that the object in the third step of the operation is to lay open the pelvis, correctly speaking this is not done; as its fascial boundaries should remain entire, with the exception of the small opening which is made in that part of the fascia covering the pelvic portion of the urethra. The angle at which the cutting edge of the knife is passed through the prostate is not only important as to the direction of the incision which it makes, but also on other accounts. If it be directed too much outwards, it is liable to wound the artery of the bulb close to its origin from the internal pudic: and if it be directed too much downwards, the rectum, vesicula seminalis, or vas deferens may be injured. If the artery of the bulb be cut in this step of the operation, so as to cause any continued bleeding, a canula, surrounded with a firm compress of lint, should be passed into the bladder. By this means the bleeding vessel may be compressed during a sufficient length of time for it to become closed, while at the same time the urine can make its escape. I do not myself believe that the internal pudic artery is ever, or, indeed, can be, wounded in the operation of lithotomy, unless it happens to be the subject of some variety in its course: this may sometimes occur, but would, I think, be easily ascertained by the surgeon, during the operation, feeling for the pulsation with his finger, as soon as he has divided the deep fascia of the perineum, and before he commences the third step of the operation.

The *fourth step* comprehends the introduction of the forceps, the grasping the stone, and its removal from the bladder.

When the bladder has been opened, as I have already described, the entrance of the knife is usually indicated by a gush of urine; but this is not always the case, and the surgeon is not to consider that he has failed in his intention because no urine flows; for if the opening he has made be no larger than the knife or other instrument by which he has divided the prostate, the water may not escape. Having opened the bladder, the operator should commence the fourth step of the operation, by taking the staff in his right hand, and introducing the forefinger of his left into the bladder, to ascertain the size of the opening made through the prostate, and also, if possible, the position of the stone. If the opening of the prostate be small, it is to be enlarged by the finger, and this is very readily and safely done, owing to the peculiar structure of that organ. The wound being made of sufficient size, and the finger still retained in it, the closed forceps are to be passed along the finger into the bladder. In fat people, it sometimes happens that the finger of the operator is not sufficiently long to reach the bladder; in that case, the blunt gorget should be employed as a director for the forceps: this is also an excellent instrument for enlarging the opening through the prostate, when from an abnormal hardness of the gland the finger is not competent to the purpose. When the forceps have been introduced, they are to be first used as a sound, to ascertain the position of the calculus; and when it is felt, the blades are to be opened, and the stone gently grasped and drawn forward, so as to enable the surgeon to examine its size and figure, and alter its position in the forceps, by means of the finger of the right hand, should it not have been seized in the manner most favourable to its extraction through the wound. When the stone is conveniently placed in the forceps, the flat part of the blades is to be turned towards the pubes and the rectum, and the stone removed by drawing it forwards and downwards towards the anus. In effecting this object, many difficulties may occur; these may arise from the position, form, consistence, and size of the stone: the surgeon's judgment must be exercised to overcome these; but I have known them prove insuperable, under the hands of the best surgeons. Occasionally, soft or friable calculi crumble to pieces before they can be extracted; in such cases it is necessary to remove as much as possible with the forceps and scoop, the remaining particles being washed out by injecting tepid water into the bladder: this process may perhaps be facilitated by supporting the patient in the erect posture during the injection. In the extraction of the stone, too much stress cannot be laid upon the necessity for gentleness in the various necessary manipulations; and when force is required, as it must often be in the extraction of large calculi, it should be applied gradually as well as cautiously, in order that the soft parts may yield to the passage of the stone, and not be unnecessarily lacerated. A difficulty frequently occurs in seizing the stone with the forceps, and is perhaps the greatest the lithotomist has to contend with: this difficulty may happen without any apparent cause, for the sound perhaps readily detected the presence as well as the position of the stone just before the bladder was cut into. The form of the calculus leads sometimes to a difficulty in its extraction; as, for instance, a very round smooth stone slips from the gripe of the forceps; and a very small one eludes their grasp, and even when between the blades its presence is not always indicated by the handles of the forceps, from its being too small to cause their separation. It has happened to myself; and I have seen others remove the forceps from the bladder of a child, with the intention of introducing them again to search for the stone, but have found it lying in the hollow of the blades: it is better, therefore, when the stone is thought to be small, to use flat-bladed forceps, which readily indicate the presence of any substance between the blades, from its preventing the close approximation of the handles.

When a round stone slips from the grasp of the forceps, a longer and larger pair should be substituted, presenting a greater extent of surface of contact: indeed, I think that all ordinary forceps are made too small, or, at any rate, too short for adult subjects.

Immediately after a stone has been removed, the bladder should be carefully searched, to discover if any other stone be left; it being ascertained that this is not the case, the patient should be released from his painful position by the removal of the ligatures; but he should not be put into bed until bleeding has ceased. When placed in bed, the thighs should be somewhat raised, by a pillow placed under the hams; the shoulders should also be elevated, to relax the abdominal muscles. The knees ought not to be tied together, as is frequently recommended; for in case of bleeding it tends to direct the blood into the bladder, where it may accumulate, unperceived, to a dangerous extent, and produce great constitutional disturbance. I have frequently known severe rigors supervene a few hours after the operation, but they cease directly a coagulum has been expelled from the bladder by its own muscular efforts. No lint, or dressing of any kind, should be applied to the wound; but in adults, a dose of opium should be administered directly after the operation: this practice is more particularly required when the size of the stone, or other circumstances, may have led to a protracted operation. But in children, on whom it rarely occupies more than a minute, or a minute and a half, it is better not to give any narcotic, or at any rate not until bed-time, when some syrup of poppies may be administered, to ensure quietude, if not sleep. The principal treatment after the operation consists in keeping the patient dry; and a double sheet should be placed under the nates, and removed directly it becomes wetted by the urine, a clean one being substituted. Urgent symptoms, however, too well known to every surgeon, frequently occur, especially in cases in which the stone has been large, and required considerable force for its removal; or when it has broken, rendering necessary the frequent introduction of forceps for the extraction of the fragments. But, in my opinion, the great source of danger is the too free incision through the prostate gland, dividing the pelvic fascia, and so permitting extravasation of urine into the cavity of the pelvis. This is evinced by a quickened pulse, hot skin, dry tongue, anxious countenance, and tenderness over the lower region of the abdomen, occasionally attended with rigors—by all the symptoms, indeed, of ordinary phlebitis. Severe antiphlogistic means must not be employed under such circumstances: leeches, and fomentations to the abdomen, with calomel and opium, and serpentary, with the liq. ammon. acet., are the remedies which should be administered. But when the extravasation has produced extensive inflammation, of the peculiar character which usually follows this condition, but little hope can be entertained of the patient's recovery; and he sinks rapidly under typhoid symptoms, attended with muttering delirium. Let me again, therefore, urge the necessity of making the opening through the prostate gland with the knife, or any cutting instrument employed for its section, as small as is compatible with the object in view. If the patient goes on favourably, about eight or ten days after the operation the urine begins to pass by the natural passage, owing to the obstruction offered to its exit through the healing of the wound in the prostate gland. Should the non-passage of the urine through the urethra be protracted beyond this period, it may be assisted by the occasional passing of a catheter; but it rarely happens that this interference is necessary.

In cases in which the calculus is too large to be extracted by the lateral operation, I believe it would be advisable to crush it by an instrument constructed for the purpose, similar to the lithotrite, only shorter and much stronger, so as to break the stone into two or three pieces, which may then be removed with the forceps. The surgeon, therefore, when from examination he expects to meet with a large stone, should be furnished with such an instrument, that he may apply it as soon as he meets with the difficulty, and not be forced to submit his patient to the operation *à deux temps*, which has been recommended by some surgeons, but which I consider in the highest degree objectionable.

In the three first steps of the operation of lithotomy, no serious difficulties can arise; at least, none that cannot be readily overcome by ordinary skill and anatomical knowledge; but in the fourth step —that is, in seizing the stone—formidable obstacles, and those of the most anomalous character, will frequently be encountered. In this part of the operation I have sometimes employed successively forceps of various forms and sizes, without being able to grasp the stone, when suddenly it could easily be seized perhaps with the very instrument that had before been used unsuccessfully; and no reason for this could be discovered, unless it arose from the relaxation of the muscles of the bladder, which had before contracted upon the stone, defending it from the blades of the forceps.

I admitted into Guy's Hospital a patient, seventy-two years of age, who was suffering from stone in the bladder; on sounding him, I discovered a large rough stone; and, passing my finger into the rectum for further examination, I so distinctly felt the tuberculated irregularity of its surface, that I was convinced that it was an oxalate-of-lime calculus. Under these circumstances, I considered the operation of lithotrity inadmissible, and proceeded to make an examination of the conformation of the perineum. I found the lower opening of the pelvis extremely contracted, the distance between the tuberosities of the ischia not being more than an inch and a half; so that the operation of lithotomy was equally unavailable with that of lithotrity; for, on measuring the stone by means of a lithotrite, I found its diameter to exceed considerably that of the lower opening in the pelvis itself.

Upon consideration of the difficulties that presented themselves in this case, I had determined, in my own mind, to prepare the patient for the operation, and to proceed in the following manner: first, to break the stone, by means of a lithotrite, into two or three pieces, and then to proceed to the operation of lithotomy for the extraction of the fragments; but, probably from the irritation set up by the examination he had undergone, although no difficulty was experienced at the time, great aggravation of the symptoms occurred, irritative fever supervened, and in four days the patient died. The plan I proposed in this case may seem inconsistent with that just recommended, viz., to break down the stone after the bladder is opened; but, on deliberation, I considered it safer to use the lithotrite whilst the bladder was intact, and could therefore be injected, rather than to attempt to seize the stone with an instrument after the bladder had been opened, and had collapsed upon the stone itself.

It is not very uncommon for the operation of lithotomy to require repetition, although, from the appearance of the stone, and the care taken by the operator in the first operation, there was every reason to believe that no portion was left in the bladder. I have seen Mr. Martineau and Dr. Rigby, of Norwich, both perform a second operation in cases of calculus. Sir Astley Cooper has also in more than one case operated a second, if not a third time; and I have myself performed the operation three times on the same individual in a period somewhat short of four years. My patient was a farmer in the vicinity of Bedford. Mr. Williamson, Mr. Beck, and two or three other surgeons of the neighbourhood, were present at these operations. In none of them was the stone broken; in each careful examination was made to ascertain if any calculus remained, and all present were satisfied that nothing was left in the bladder. Notwithstanding all these precautions, it became necessary to cut the patient a second and a third time at the expiration of about fourteen months between each operation; and I am happy to say that he is still alive, and perfectly free from calculus disease, twelve years having now elapsed since the last operation.

It has been recommended by some lithotomists, that, in second operations, the incision should be made on the right side of the perineum, rather than through the old cicatrix; but I think this perfectly unnecessary, and wrong, because it is inconvenient. In the case I have just alluded to, I operated each time on the left side, and the wound healed as readily after the third as after the first operation: indeed, in three weeks he attended in the fields, as the operation happened to be performed during the hay harvest.

Before a patient who has been submitted to this operation be dismissed from medical care, the stone, as well as the urine, should be analysed, that remedies may be prescribed to diminish the liability to the recurrence of the disease.

Patients should not be kept on spare diet after the operation of lithotomy, nor, indeed, after any severe ordeal of the kind. It should always be remembered, that you cannot diminish constitutional power without increasing irritability; and that, consequently, support is generally requisite, and should be early prescribed. I am sure that one of the greatest modern improvements in the treatment of patients who have undergone surgical operations, is with respect to the better diet that is early permitted to them; and from this, I believe, arises the greater comparative success of operations in this than in any other country.

LECTURE XLIX.

CONTINUATION OF STONE IN THE BLADDER.

Difficulties which may impede the operation for stone—Impossibility of removing a stone, in consequence of narrowing of the pelvis—Breaking down the stone—Case—Difficulties arising from enlarged prostate, and from contraction of the bladder upon the stone—Calculus deposited in artificial sac—Cases—Immediate cause of death in cases of stone—Stone in the female—Less frequent than in the male—Symptoms—Retention of urine—Case——Removal of calculus by dilatation—Lithotomy in the female—Foreign bodies in the vagina—Treatment after operation—Case—Importance of disease of the kidnies in relation to lithotomy—Bright's disease—Symptoms of kidney disease—Symptoms of ulceration of bladder—Danger in lithotomy from constitutional, not local, causes—Cases.

Varieties of calculi, their chemical composition and character—Characteristics of urine indicating calculous tendency—Use of solvent injections—Concluding remarks.

There are still some difficulties to be mentioned which may occur in the operation for stone: one of the most formidable of these is a narrowing of the pelvis from rickets. Sir Astley Cooper describes an operation which he saw performed by Mr. Cline, in which the ischia were so abnormally approximated from distortion, that, after having introduced the forceps and seized the stone, it was found impossible to withdraw it; fortunately, however, after several attempts with a strong pair of forceps, he succeeded in breaking the stone, and removed it piecemeal. A short strong lithotrite, such as I have already spoken of, would in such a case be very useful. Enlargement of the prostate often leads to difficulty in the extraction of the stone, especially if it be abnormally hard; indeed, under such circumstances, I have seen the prostate gland brought to the external wound in the attempts to remove the stone; and in some cases large portions of the gland have been known to be torn away. I once saw Mr. Liston, in operating at the University Hospital, bring away a considerable portion of prostate gland in removing a large calculus: the patient recovered, however, without any bad symptom. I am therefore disposed to believe, that although the gland was lacerated, its fascial capsule was left intact, so that no extravasation of urine followed the lesion. Contractions of the bladder around the calculus frequently obstruct its withdrawal; in such cases patience only is required, for the contraction generally results from the sudden escape of the urine when the bladder is cut into, and if the forceps be not immediately employed, the muscles soon relax, and the difficulty disappears.

The stone sometimes ulcerates from the bladder, and forms a pouch between the bladder and the rectum; in this pouch it may partly rest as well as in the bladder. Mr. Hancock, of Charing Cross Hospital, lately had a case of this kind, in which, in performing the operation of lithotomy, he encountered no difficulty until he passed the forceps, when he was unable to discover the calculus: the patient was put to bed, and subsequently died. Upon a post-mortem examination it was found that a large adventitious sac had been formed between the bladder and rectum, freely communicating with the former, and appearing to have been converted into the receptacle for the urine, while the bladder itself was much contracted, and contained the calculus.

My colleague, Mr. Cock, had lately a very similar case. A patient was admitted almost in extremis from protracted retention of urine: Mr. Cock proceeded at once to relieve the patient by puncturing the bladder per rectum: he died; and upon a post-mortem examination it was found that a large adventitious sac had been formed between the bladder and rectum, precisely similar to that in Mr. Hancock's case.

A case of incarcerated calculus, which is very rare, lately occurred in the practice of M. Roux, at the Hôtel Dieu, Paris. The patient, aged 25, complained of pain and uneasiness in the urinary organs, chiefly in the bladder; and described that during micturition he felt as if some burning substance were rolling along the urethra, until it rested in the glans, when the sensation became exquisitely painful. M. Roux several times sounded the bladder, and detected a hard resisting body fixed in one spot: upon being struck it gave a sound perceptible both to the surgeon and those standing around. The stone appeared to be situated towards the anterior part of the bladder, a little to the right of the median line. The lateral operation was adopted in this case, and before the incision was made, the presence of the stone was again verified by percussion. The bladder being opened, no stone, could, however, be found, although search was made by many different instruments; but the staff introduced through the wound, on being struck against the anterior wall, gave the same sound as before. M. Roux therefore renewed his search, which he continued for upwards of half an hour, but still without finding the stone: he consequently desisted, the patient was put to bed, and after the operation continued to go on favourably. The operation was to be repeated when the patient had sufficiently recovered from the effect of the first operation, but I have never had an opportunity of learning the ultimate result of the case.

In the post-mortem examination of patients who have died from the operation for stone, the immediate cause of death is usually not very apparent, but a general diffused subacute inflammation of the peritoneum presents itself, with more or less effusion of flocculi of non-plastic matter, resembling very much the appearance in death from puerperal fever. Not unfrequently a sloughing of the cellular membrane is found passing from the prostate upwards, between the bladder and rectum, filled with a sanious effusion, and resulting from the fascia of the prostate having been cut through, allowing of the extravasation of urine: this is by far the most frequent cause of death in the operation for stone. A general subacute inflammation is also found over the surface of the peritoneum, attended by an effusion of non-plastic matter, sufficient to produce slight adhesion of the folds of the intestines, but being very different from that adhesion caused by acute inflammation. Hiccup and sickness, so frequently attendant upon this condition, indicate the extension of the inflammation to the peritoneal coverings of the stomach and diaphragm, and must be always regarded as a very dangerous symptom. The mucous membrane of the bladder is often found highly vascular, or its vessels replete with coagulated blood, giving the appearance of ecchymosis: sometimes it is also found in a state of ulceration. The muscular coat is generally thickened, so as to encroach upon the cavity of the bladder and diminish its capacity; this may be one cause of the contractions of the bladder around calculi, to which I have already alluded. The ureters are not unfrequently found much dilated; and I have met with a case, in which the patient had died from stone, where the left ureter was impervious at its termination in the bladder, but was extremely dilated from that point up to the kidney, and a large diverticulum, of two inches in length, filled with urine, had formed in the ureter, just above its termination in the bladder.

The kidnies are frequently diseased in cases of stone: they may be either distended with calcareous matter or with urine, to an extent which may lead to the insterstitial absorption of the whole of their secreting structure, or, as sometimes happens, they will be found much wasted; such extensive disorganization must, however, have been indicated during life, and would have precluded the performance of the operation.

Stone in the female.—Calcareous deposits, it is said, occur much less often in the female than in the male; but probably this assertion is not so correct as its frequency would lead us to suppose; the rare occurrence of accumulations of calculous matter in the bladder may, however, arise from the shortness and large size of the meatus urinarius in the female. There is, in fact, no apparent reason why the blood in the female should be purer, or why the kidnies should be better able to eliminate the due proportion of the natural constituents of the urine, unless, perhaps, the usual mode of life is more regular, and the dietetic observances stricter, among females than among males. Sometimes, however, calculi form in the female bladder, and the symptoms produced by their presence are very similar to those in the male, attended perhaps by more "bearing-down pain," in consequence of the irritation produced upon the uterus; women also suffer more from incontinence of urine in consequence of the shortness of the urinary passages. Retention of urine is a frequent result of stone in the bladder in the female, from the liability of the extraneous body to become impacted in the meatus urinarius, precluding the possibility of micturition, and requiring its immediate removal for the patient's relief. I admitted a patient (a girl of 12 years old) into Mary's ward, who was the subject of retention of urine, and upon examination I discovered a foreign body within the meatus. On attempting to extract it with forceps, I accidentally pushed it back into the bladder. I found it impracticable to remove the stone at the time, and proceeded to dilate the urethra by means of sponge tent; but this method produced so much pain that I was obliged to substitute the use of Weiss's urethral dilator. In a few days I was able to pass forceps into the bladder, and extract the stone without cutting. This mode of operation should not be adopted if the stone be large, as it would lead to the necessity for such a dilatation of the meatus as would probably render it incapable of being restored to its natural size, and permanent incontinence of urine would be the result.

To remove large calculi, the female patient should be placed in the same position as the male, and confined in the same manner; a straight staff is passed into the bladder, and held by an assistant; a knife is then introduced along the groove, and the incision made in an oblique direction downwards and outwards, between the vagina and ramus of the ischium, in the same direction as in the male, but to a less extent; the forceps are then introduced, and the calculus removed.

I have twice performed this operation, and in both cases the patients recovered without any permanent incontinence of urine; while in the case by dilatation related above, although the incontinence was not permanent, it was many months before the patient had the power of perfectly retaining her urine. Many surgeons recommend the operation of cutting in all cases, in preference to that of dilatation, in consequence of the much greater liability to incontinence from the latter; but I confess, from what I have been able to learn from the experience of others, I am led to believe that incontinence results as much from the one as the other operation; I should recommend dilatation where the calculi are small, and lithotomy where they are large.

Calculi in the female, as well as in the male, are frequently found concreted upon foreign bodies; and Sir Astley Cooper relates a case in which he removed from the bladder of a woman a calculus of which a large portion of a brass nail formed the nucleus. This calculus is preserved in the collection at St. Thomas's Hospital. The means by which such substances have been introduced are too obvious to require any explanation. Mr. Cline's well-known case, in which a quantity of coal had been passed into the vagina, while the woman declared herself to be the subject of stone in the bladder, is a further instance of that peculiar kind of depravity which frequently falls under the notice of the surgeon.

The medical treatment of the premonitory symptoms of stone, the means of relieving the pain arising from its presence either in the kidney, ureter, or bladder, and the plan to be adopted to prevent the recurrence of the concretions after the calculi have been removed, are precisely similar to those which have already been recommended in the male subject. The danger in the operation for stone in the female is infinitely less than in that of the male, as would be readily conceived from the different conformation of the external generative organs. I once assisted Mr. Costello in an operation for the stone in a female at Greenwich, in whom the stone was so large as to preclude the employment of lithotrity; and he therefore performed the operation of lithotomy. On passing the forceps into the bladder, and seizing the stone, the difficulty of removing it was so great, from its size, that he intentionally laid open the rectum to facilitate its extraction. The patient recovered without a dangerous symptom, but afterwards had permanent incontinence of urine and fæces. The stone in this case weighed seven ounces.

The after-treatment in lithotomy in the female is much the same as in the male, but, in addition, the introduction of an elastic catheter is required to prevent extravasation of urine into the cellular tissue around the vagina. In cases where the stone is too large to be removed by dilatation, yet not so large as to prevent its being crushed, the operation of lithotrity is highly applicable; but I think a lithotrite should be made expressly for the female, as the length of the instrument employed in the male would be inconvenient.

Although every care may have been taken in preparing the patient for the operation of lithotomy, and the utmost caution and skill employed in the operation itself, the termination of the case cannot be looked forward to with that confidence in success that we should be led to expect from a cursory consideration of the character and formation of the involved organs. It must, however, be borne in mind that the formation of the stone is probably the result of deterioration of the secreting urinary organs, which are themselves highly important to life in their office of depurators of the blood; and when they become the subjects of disease, the constitution generally must be proportionably affected.

We are indebted to Dr. Bright for the discovery of a peculiar diseased state of the kidnies, indicated by an albuminous state of the urine; and from the knowledge thus obtained, the circumstances under which the operation ought or ought not to be performed are well marked, and the prognosis much more closely defined. It has been shown that persons affected with this disease are particularly disposed to inflammation of the serous membranes; and it must be apparent that, under such circumstances, a surgical operation, particularly such as lithotomy, must give rise to a most dangerous liability to peritoneal inflammation. This view is borne out by the fact that, in a large proportion of the patients who die of peritonitis from the effects of this operation, the kidnies are found in a diseased state; but even in cases in which peritoneal inflammation has not supervened in consequence of disease of the kidnies, the patients frequently sink into collapse after formidable operations, without there being any attempt at reparation.

It is an important subject for question, whether in any case an operation should be performed on a patient labouring under "morbus Brightii." The existence of this disease up to a certain extent may not perhaps militate against the performance of a surgical operation; but wherever it exists, in however slight degree, the prognosis is certainly proportionably unfavourable. When stone in the bladder is concomitant with this condition, lithotrity may often be employed as the least dangerous operation, and may be resorted to when lithotomy is totally inadmissible.

When pus occurs in the urine as a concomitant symptom with stone, it becomes very difficult to determine whether it be derived from the kidnies or from the bladder. In either case the operation ought to be postponed, and the normal state of the urine restored, if possible, by the use of medicines and by strict attention to diet. If the pus proceed from the kidnies, the dangers of the operation are greatly enhanced, and the chances of recovery rendered very slight; indeed, if this condition of the kidnies does not yield to medical treatment, death is inevitable, independently of the influence of the stone.

When pus arises from the bladder, it does not generally preclude the performance of lithotomy, even although the remedies adopted may fail in checking its formation; indeed, I have known the bladder to entirely recover as soon as the stone was removed. The important question in these cases would be, whether the kidnies or bladder, or both, are diseased. This question is very difficult of solution, and can, I think, only be answered by closely studying the history of the case; for it generally happens that, in disease of the kidnies, the patient will have suffered a deep-seated pain in the loins long before any abnormal condition of the urine has been detected. Enlargement and tenderness in the lumbar regions may also have been present, indicating disorganization of the kidnies. When the bladder is the seat of the disease, it is preceded or accompanied by pain above the pubes, and by mucous and earthy deposits in the urine.

These considerations lead me to the belief that it is from constitutional, and not local causes, that danger is to be apprehended in the operation of lithotomy. Circumstances may certainly arise in the operation itself which may prove highly dangerous, such as severe hæmorrhage, laceration during the extraction of a very large stone, or from the frequent introduction of the forceps; but even where death results from injury to the bladder, the fatal termination may in general be traced to reaction on the kidnies, and interference with their depurative function, and not to mere lesion of the bladder itself; not that I would be understood to inculcate a neglect of any of the usual and proper precautions taken in making the incision through the prostate in this operation; for if completely divided in a case where there was a tendency to kidney disease, death would be almost certain to follow; and even in a healthy patient there would be great danger. Where the individual is, however, in good health, it is surprising to see the amount of comparative violence the bladder will sustain without any constitutional disturbance being produced. I have lately had a patient, a gentleman formerly in the 5th Dragoon Guards, upon whom I have performed the operation of lithotrity for a large stone. It was proposed at first to employ lithotomy; but he determinedly objected to this, and I therefore crushed the stone. I have repeated the operation fourteen times, without at any time producing more than temporary inconvenience, and he has generally walked home from my house after the operation. I have always in this case prepared the patient by a dose of forty drops of laudanum, given about two hours before the operation.

The following cases will, I think, be found useful, inasmuch as they show the principal circumstances attendant upon a fatal termination to the operation of lithotomy, and are illustrative of the views I have just detailed:—

Edward Price, æt. 30, admitted for stone in the bladder, which he has had 18 years. The operation was attended with considerable difficulty, from the size and friability of one of the calculi found in the bladder: it was as large as a small egg, and of a lamellated structure, so that when seized it broke down, and required several introductions of the forceps: besides this stone there was another, considerably less in size. The patient died the day after the operation, being unable, from the shattered condition of his constitution, to sustain the shock; indeed, the operation was only performed in compliance with the anxious desire of the patient. On opening the body, there was found extensive peritoneal inflammation, particularly in the lower part of the abdomen; the parietes of the bladder were thickened, as was also the mucous membrane, which was granular, and of a livid and dusky red colour. The ureters were tortuous, and as large as the finger, and the pelvis of each kidney was greatly dilated: the kidnies contained numerous large cysts; this was particularly the case with the left, of the glandular part of which very little remained. The mucous membrane of the stomach and duodenum were also much thickened.

Stephen Pollard, æt. 53, had been subject to gravel for seven years, and he suffered from all the symptoms of stone in the bladder. In the operation some difficulty arose in seizing the calculus, which was ultimately detected behind the pubes. Soon after the operation, pain in the abdomen supervened, with quickened pulse and nausea, and the patient continued to become more and more depressed until his death, about forty hours after. When examined, the kidnies were found to be of moderate size, soft and flabby, and in an advanced stage of the light mottled deposit described by

Dr. Bright: there was also inflammation of the peritoneum, and the cellular membrane behind the peritoneum was extremely lacerable, breaking down easily under the finger. The peculiar condition of the kidnies here mentioned has been noticed in several cases where the patients have sunk after the operation of lithotomy.

George Willis, æt. 48, had laboured under disease of the urinary organs for about eighteen years. From the extent of disease of the bladder, this man was a most unfavourable subject for the operation: but it was, nevertheless, performed at his own urgent desire. After death, the body was examined: the kidnies were found to be large, soft, and lacerable; there were two or three urinous cysts in the left kidney, and its substance was unusually pale; the ureters were less than natural; the liver was mottled, and contained a good deal of bile, and was rather soft and fatty: the bladder was of moderate size, flaccid, and sacculated; it contained two small concretions of calcareous matter. In this case, the patient never rallied after the operation, as if the constitution were incapable of any restorative effort. Lithotrity would here, perhaps, have afforded the best chance of success; but the narrowness of the urethra, from an old permanent stricture, precluded the use of the lithotrite.

John Perring, a sailor, æt. 44, admitted into the hospital for the purpose of having a piece of bougie removed from the bladder. The operation was performed in the usual manner. In removing the extraneous substance, it was found necessary to employ the scoop, and two or three different kinds of forceps, on account of its peculiar situation in the bladder, and the friability of the calcareous matter deposited upon it: the patient did well at first, but fever set in, and the accession of unfavourable symptoms went on for three days, when he died. Post-mortem examination:—The kidnies were the only organs importantly diseased; they were very soft, of a lobulated and granulated texture, and presented a mottled aspect when deprived of their investing membrane; there was not the least attempt at reparation, either in the wound through the prostate, or in the perineum. In this case, there can be no doubt that the urine, if tested, would have been found albuminous; and the diseased state of the kidnies must be looked upon as the cause of death.

John Bartlet, æt. 22, admitted into the hospital, with stone in the bladder. Injured his loins about seven years previously, and afterwards suffered pain, and occasionally passed bloody urine. The operation of lithotomy was performed, and a flattened stone, about the size of a date, removed without any difficulty: soon after the operation, the patient was seized with great pain, shivering, and sickness; peritonitis supervened, and he died five days after the operation. On examination after death, there was found diffused inflammation of the peritoneum, implicating that membrane where it covers the liver, stomach, and diaphragm. The lungs were congested, and the left kidney nearly gone, the pelvis and infundibula being much dilated: the right kidney was very large and mottled, but the bladder only slightly diseased.

Thomas Kenesley, æt. 72: the operation of lithotomy was performed; but some difficulty was experienced in placing the patient in the required position, owing to the right knee-joint being stiff from the presence of a loose cartilage. After the incision had been made through the prostate, it was with considerable difficulty that the stone was removed. The patient gradually sank, and died on the sixth day. On a post-mortem examination, the kidnies were found of the ordinary size, surrounded by a large quantity of fat, very flabby, exsanguine, and the central portions slightly diseased. The ureters were both dilated to twice their natural size, and contained urine, which was coagulable by heat. The liver was also very small, pale, and flabby. Some of the other viscera presented slightly abnormal appearances; but to the diseased state of the kidnies must be ascribed the rapid prostration under which the patient sank immediately after the operation.

In the course of my practice I have performed the operation of lithotomy on 134 different individuals, and my average of success has been fourteen out of fifteen. A large number of these were, however, young persons, and in them the danger is far less than in patients who have attained the age of puberty.

I cannot help thinking, that the operation of lithotrity is fast superseding that of lithotomy; and although the above statistics would encourage us to look forward with some confidence as to the result of the latter operation under commonly favourable circumstances, I do not consider that it ought ever to be adopted, and the danger incurred (which must always to a certain extent be present), in any case in which the safer operation of lithotrity can be employed.

The constituent parts of urinary calculi are necessarily the same as of those deposits which take place from the urine upon cooling, or from any other cause which renders it incapable of holding them in solution. But calculi derive their particular name from their preponderating ingredient; it is seldom they are met with, perfectly pure; therefore when we speak of a uric-acid or phosphate-of-lime calculus, we intend to imply that such a stone contains more of these substances than of any other.

The following are the chief varieties of calculi:—

1st. *Uric* or *lithic acid.*—This is the most common of all the constituents of calculous concretions: a uric-acid stone is of a reddish brown, or fawn colour, hard, inodorous, and frequently of an ovoid form, or sometimes flattened, smooth, or studded with tubercles, which are also smooth, and never present the rugged processes so common in some other calculi. It saws hard, and the detritus is of the same colour as the calculus itself, but somewhat lighter. Uric-acid calculi are composed of concentric laminæ, of a crystalline texture. The kind of urine which indicates an excess of uric acid is described by Dr. Golding Bird, as being principally of a deeper colour than natural, of a specific gravity above 1·020, and of an acid reaction great in proportion to depth of colour.

A pure lithic-acid calculus, when powdered and digested in dilute caustic potash, is entirely dissolved, and on adding hydrochloric acid, a white precipitate immediately falls.

Whatever may be the preponderating ingredient of a urinary calculus, the nuclei are most frequently composed of uric acid, or one of its salts; according to Dr. Golding Bird, out of 394 calculi preserved in the museum at Guy's Hospital, 269 were found to have nuclei composed of uric acid or urate of ammonia. The utility of examining the urine in cases where there is a tendency to deposition from that fluid, is in no instance better exemplified than in those in which uric acid preponderates; for having ascertained *the fact*, the remedies are clearly indicated, and their administration generally effective. Diaphoretics produce the best possible effect; and Mr. Copeland Hutchison has stated it to be his opinion, that the extraordinary freedom of sailors from calculous affections arises from the closeness and heat of their sleeping-places, in consequence of which they are, during the night, bathed, as it were, in perspiration. I confess I am rather sceptical on this point, and believe that sailors often become invalided in consequence of their incapacity to perform their duties, from the premonitory symptoms of stone, or even at the first formation of the calculus; for I have on several occasions performed the operation of lithotomy on sailors; and remember that Sir Astley Cooper once told Mr. Copeland Hutchison that he had himself operated upon more cases of stone in seamen, than that gentleman had statistically reported as having existed in the navy during a period of fifteen years.

Great attention to the digestive functions constitutes a point of much importance in the prevention of deposits of uric acid. Highly nitrogenized food should be avoided, and alkaline remedies prescribed. Carbonate of soda and potash, with infusion of gentian, is an excellent remedy, not only for restoring the tone of the digestive organs, but also for preventing the deposit of uric acid. But should it already have occurred in the form of "gravel," the *borate of soda or potash*, with cream of tartar, is the best solvent that can be administered; and should there be much irritation concomitant with the other symptoms, Dover's powder should be given during the use of the other remedy. So far as my own experience goes, I am inclined to believe that the uric-acid calculus produces much less constitutional disturbance than any other, and that when cut, patients recover more rapidly than in other cases.

2nd. *Urate* or *lithate of ammonia*, varies from a fawn to a light gray or clay colour, but is sometimes of a yellow tint, presenting a dull earthy appearance, amorphous, having no signs of crystallization upon fracture.

The urine containing a preponderance of this constituent is generally of a lower specific gravity than that containing excess of uric acid, but rises higher in the scale in proportion to the colouring matter (purpurine) it contains. It also becomes turbid on cooling, but clears rapidly again upon the application of heat.

Urate of ammonia calculi frequently contain soda, and a trace of phosphate of lime. Under this composition they seem to have a tendency to form only of a small size. And in a case in which Sir Astley Cooper removed no less than 142 calculi from the same individual, by means of Mr. Weiss's forceps, they were of this nature.

3rd. The *phosphate of lime*, or "*bone-earth*" *calculus*, is of a pale brown colour, frequently of a smooth surface, as if polished. Internally, it is disposed in laminæ, very easily separable from each other, and yielding readily to the saw, producing a white powder. They are rarely found pure; but those which approach nearest to purity seem to be formed in the prostate gland, especially in old people.

The urine which contains such a preponderance of phosphate of lime that its free acid cannot hold it in solution, is turbid, generally pale in colour, and minute amorphous granules, which are readily dissolved by hydrochloric acid, can be seen floating in it. Urine containing the earthy phosphates to such an extent as to lead to their deposition, presents, therefore, an alkaline reaction, or is at any rate neutral.

These calculi most frequently form in old persons, when the elimination of bone earth from the blood ceases to be vigorously carried on by the capillaries of the osseous system. But why these concretions should have a tendency to form in the prostate gland, and not in the bladder, is a point which yet remains unexplained.

4th. The *triple phosphate calculus,* or *ammoniaco-magnesian phosphate,* is usually of a clearer white, and more spar-like appearance, than the phosphate of lime; it is not laminated, and is easily reduced to powder. Its surface is generally uneven, and frequently covered with minute shining crystals, which are also found between its interstices. Such calculi are scarcely, if ever, composed wholly of the ammoniaco-phosphate of magnesia, but it is generally mixed with the phosphate of lime, constituting what is termed the fusible calculus.

5th. *Fusible calculus* resembles physically a mass of chalk disposed in laminæ, which may be in some parts separated by shining crystals of the triple calculus. In some instances these calculi will be found of a spongy texture: they are frequently of a large size, and moulded in the form of the cavity of the bladder. This calculus is termed fusible, from its readily fusing before the blow-pipe.

Urine containing deposits of the phosphates presents the appearance of a dense cloud of mucus floating in it, and becomes immediately clear upon the addition of a little hydrochloric acid. Such urine is generally alkaline, but not invariably so; for, although the phosphates are so readily soluble in weak acid, the presence of the hydrochlorate of ammonia in the urine may afford an acid reaction: this explanation has been given by Dr. G. Bird.

Urine containing the earthy phosphates in solution becomes turbid on the application of heat; and this phenomenon must not be mistaken for the presence of albumen, the distinction being readily made by the addition of a drop of nitric acid, which dissolves the phosphatic deposit, but tends rather to increase the turbidity of an albuminous deposit.

6th. The *oxalate of lime* or *mulberry calculus* is usually of a dark brown colour, with a rough tuberculated surface; whence its name. Upon being cut into, it varies in colour, its laminæ (which are rarely in a concentric form) being alternately lighter and darker, like the surface of the "fortification agate." The specific gravity of these calculi is usually great: they offer considerable resistance to the saw, and the powder which falls is of the colour of the aggregate mass: but the tint differs very much in different specimens.

The urine containing oxalate of lime is, according to Dr. Bird, generally of an amber colour, sometimes quite clear, at others more or less turbid: its specific gravity is low, decreasing from the normal state in proportion to its paleness. Epithelial scales are almost invariably found in the urine of patients the subjects of calculus of this nature, attributable probably to the roughness of the surface of the stone. The presence of the octahedral crystals of oxalate of lime is frequent in the urine of dyspeptic patients. This condition readily yields to judicious dietetic observances, therefore the presence of these crystals is no evidence of the existence of stone. The common garden rhubarb, taken as food, will always produce the presence of these crystals; and, therefore, in persons having a tendency to calcareous formations, this vegetable should be avoided. This is also the case with the onion, which is found by Dr. Bird to contain quite as large a quantity of oxalic acid, although it has been generally allowed to be freely taken by calculous subjects.

7th. *Carbonate of lime calculus* is very rarely met with; it may be readily recognised by its snowy whiteness, and its dissolving in weak acid with effervescence.

8th. The *cystic oxide calculus* is a very rare kind of concretion. In physical condition they vary very much, some being quite smooth, and others tuberculated. In colour, they are usually of a yellowish white externally, and of a sea green internally; the latter colour sometimes pervades the whole mass, and is highly characteristic. These calculi are generally remarkable for their purity; this has induced Dr. Marcet and Dr. Prout to believe that the cystic oxide is never accompanied by the matter of any other concretions. But Dr. Golding Bird doubts the accuracy of this opinion, from the analyses he has made of the section of a calculus in the Museum at Guy's Hospital, in which a lamina of cystic oxide encloses a nucleus of oxalate of lime, being itself surrounded by a zone of urate of ammonia, mixed with a considerable quantity of cystine.

The urine indicating the cystic oxide diathesis is usually of a pale amber colour, and sometimes of an apple-green tint, which is very characteristic: it is also of low specific gravity, and generally turbid, depositing a reddish muddy cloud, which clears on the application of heat, probably from the presence of lithates.

9th. *Xanthic oxide* is another species of calculus, which was first described by Dr. Marcet. This concretion is of a reddish-yellow colour, soluble both in acids and alkalies; and if portions of the stone be dissolved in nitric acid and evaporated, the residuum assumes a bright yellow colour: the concretion owes its name to this peculiarity.

10th. The *fibrinous calculus*, according to Dr. Marcet, is of a yellowish brown colour, resembling bees-wax, having somewhat the same consistence; the surface is uneven, but not rough; the texture fibrous; the fibres radiating from the centre, and somewhat elastic to the feel. When exposed to the flame of a spirit-lamp, it takes fire, swells, blackens, and ultimately becomes converted into a spongy carbonaceous mass, and emits an animal smell, like that of meat. Indeed, in every property, this concretion corresponds to fibrin; for, when boiled in dilute acetic acid, it is dissolved, and, upon the addition of the phosphate of potash, a yellow precipitate is formed.

The subjects of this concretion are generally liable to hæmaturia; and I think there can be no doubt that the fibrin of effused blood forms the nucleus of the calculi: they generally spontaneously pass through the urethra, and thus the patient becomes relieved. I have known patients the subject of stone in the bladder pass such substances, probably arising either from the effusion of blood into the bladder, or from the deposition of lymph resulting from the irritation of the stone. They can scarcely be said, therefore, to be calculi, but ought rather to be considered as causing the deposit of the urinary constituents upon them.

11th.—The *alternating calculus* may be composed of different species deposited in concentric layers—as, for instance, uric acid may form a nucleus, phosphate of lime surround it, oxalate of lime enclose that, and, lastly, an outer layer of the fusible calculus surround all. Such compound calculi are not at all unfrequent, the differing composition of the strata depending upon the changes in the health of the patient, and perhaps also on the remedies prescribed.

From the facility with which urinary calculi are dissolved by chemical menstrua, the hope has naturally arisen in the minds of surgeons, that remedies might be applied, either through the medium of the blood, or by injection into the bladder, capable of removing the extraneous matter; but, as I have already said, all such attempts have hitherto failed, in consequence of the strength of the reagents required to produce the desired effect being greater than the bladder is capable of sustaining; the remedy becoming, indeed, worse than the disease it is intended to remove.

LECTURE L.

DISEASES OF THE GENITAL ORGANS.

Genital organs of the male—Partly external, partly internal—Diseases of the genital organs—Irritable state of vas deferens—Symptoms — Vesiculæ seminales — Diseases of the testicle—Inflammation or orchitis—Acute orchitis—Symptoms—Treatment — Rheumatic orchitis — Hardened testicle—Treatment—Chronic orchitis—Symptoms—Treatment—Modifying circumstances—Chronic abscess of the testicle—Granulations—Their removal—Medical treatment—Escharotics—Cases—Atrophy of the testicle—Causes of atrophy—Treatment—Fibrous testicle—Its causes—Irritable testicle—Symptoms—Sometimes only temporary—Treatment—Extirpation of testicle—Examination of urine—Treatment—Neuralgia in the testicle—Syphilitic orchitis—Difficulties of diagnosis—Treatment—Case.

Malignant diseases of the testicle—Medullary sarcoma—Soft cancer similar to hard cancer, but occurring in different constitutions—Symptoms—Physical character—Course of the disease—Diagnosis—Treatment—Change of structure of the organ—Case.

In the male, part of the genital organs are internal and the others external to the cavity of the abdomen: those within the cavity are, the prostate gland, the vesiculæ seminales, and part of the vasa deferentia; while those that are external to it are, the penis, testicles, spermatic chords, and scrotum. Every one of these organs is subject to diseases peculiar to itself, and it is therefore necessary that each should receive a separate description. Of the abnormal changes to which the prostate gland is liable, I have already spoken in a preceding lecture, but my remarks then referred to it rather as a urinary than as a generative organ; it is in the latter character that I now again return to it, as it is not unfrequently the seat of disease, in consequence of its intimate connexion with the vasa deferentia and vesiculæ seminales; and, under these circumstances, it is the generative, and not the urinary, function of the organ that undergoes disturbance.

Irritable state of the vas deferens.—The vasa deferentia constitute the excretory ducts of the testicles; they take their course upwards from those organs, forming part of the spermatic chords, and, entering the external abdominal ring, traverse the inguinal canal, pass through the internal ring, and, being continued to the sides of the bladder, ultimately terminate in the prostate gland. At their extremities, the vasa deferentia appear to be subject to a peculiar sensitiveness, sometimes leading to a train of symptoms by which the above disease can be recognised; viz., a deep-seated pain in the prostate gland, extending along the urethra, greatly increased in micturition, and becoming extremely acute during the emission of the semen, the aggravation of the pain lasting two or three days after coition. The uneasiness and pain usually extend along the vas deferens to the testicle, and this constitutes the principal diagnostic mark between it and disease of the prostate gland itself. Persons suffering under this peculiar irritation are very liable to nocturnal emissions, which, from their depressing influence, constitute one of the most distressing symptoms, and, indeed, is that which occupies so prominent a place in the mind of the patient, that he loses sight of the other symptoms, and the surgeon is only led to examine for the local cause, by finding that tonics, cold bathing, &c. fail to check these involuntary emissions.

The great pain produced in passing the water, often, however, induces the surgeon to introduce a catheter for the purpose of examining the state of the urethra: the passage of this instrument through the prostate increases the suffering, and a slight obstruction may be experienced on its entrance into the bladder. If these symptoms be not relieved, irritable testicle and spermatorrhœa usually supervene; but it is said that the original disease may almost invariably be cured by the application of caustic to the veru montanum. Lallemand has particularly directed his attention to the application of caustic in these cases, and has invented an instrument for this purpose: it consists of a canula, which is passed down to the obstruction offered by the irritated ducts; and a piece of caustic previously fixed to a rod passing through the tube is then pushed forward, and thus brought in contact with the seat of the disease. I have found, in my own practice, that the common caustic bougie answers the purpose equally well: but I cannot say that the treatment is so successful as Lallemand states it to have been in his practice. I have therefore been obliged to have recourse to constitutional remedies, paying strict attention to the diet of the patient, and employing chiefly those medicines best suited to improve the assimilative powers. At the same time, it is often necessary to give narcotics to allay the irritability which is generally attendant upon this disease. It is a peculiar feature of the disorder, that the patient is impressed with a most morbid feeling as to its importance and danger, and the mind is frequently so much affected with this idea as to be incapable of any healthful exertion. One of the principal objects of the surgeon is, therefore, to remove this mental condition by convincing the patient that the disease is not so serious as he imagines, and that under judicious treatment it is neither permanent nor dangerous.

The vasa deferentia are not very liable to disease unless they become secondarily affected by the extension of morbid action from the testicle; their coats are, however, sometimes found thickened, and I once saw a small sero-cyst attached to the vas deferens of the left side.

The *vesiculæ seminales* are but rarely attacked by disease, but they are sometimes found after death filled by scrofulous deposits of the cheesy matter so frequently met with in different parts of the body in strumous diatheses. The mucous membrane lining the vesiculæ seems to be liable to a chronic thickening, attended with an increase of discharge, and, according to Lallemand, this condition is usually concomitant with involuntary seminal emissions. In some cases the vesciculæ seminales have been found wasted; this usually results from atrophy, or the removal of the testicles, but it may likewise be the consequence of some cause originating in the vesiculæ themselves. Bony deposits, thickening of the tunics, and the formation of cysts, are changes which have been observed in connexion with these organs, although during life there were no symptoms indicative of the morbid condition of the parts: this may probably have arisen from so little being known of their function in health.

DISEASES OF THE TESTICLE.

Inflammation or *orchitis.*—This disease may occur either under an acute or chronic form, and may attack indiscriminately the secreting or excreting portion of the testicle. When the body of the testicle becomes affected, the attack arises either idiopathically or in consequence of external violence; but when the inflammation is seated in the epididymis it is usually a secondary effect, resulting from irritation in the urethra, and the extension of the disease along the vas deferens.

Acute orchitis is indicated by pain and swelling in the affected part, and a sensation of weight, which is greatly increased if the testicle be allowed to remain suspended by the spermatic chord, along which the uneasiness passes to the region of the loins. Nausea is also a very frequent concomitant of this complaint; nor is this an inexplicable symptom, for it should be remembered that the spermatic nerves are derived from the greater and lesser splanchnic plexuses. As the disease progresses, the pain increases to an intense degree, and the recumbent posture alone affords ease to the patient: the whole scrotum becomes inflamed and red, and the constitutional symptoms begin to be urgent; the skin is hot and dry, the tongue white, pulse rapid, and a high degree of irritative fever developes itself; and unless strict antiphlogistic means be adopted, there is a great liability to the formation of abscess. If the patient be of a full plethoric habit, blood may be taken from the arm; but it is more usual to employ leeches. In my own practice I always recommend cupping on the loins, in addition to the leeches, taking away about ℥viij. of blood; and I have found, by experience, that the pain is relieved with much more certainty by this plan, than when leeches alone are employed; I also generally prescribe the following internal remedies:—

℞ Hydrarg. Chloridi, gr. iss.
Pulv. Antim. Potassio-Tartratis, gr. ⅓.
Pulv. Opii, gr. ½. M.
Ft. pilul. statim sumenda.

℞ Magnes. Sulph. ʒiij.
Liq. Ammon. Acet. ℥j.
Liq. Antimon. Potassio-Tartrat. ʒiss.
Træ. Hyoscy. ʒiss.
Aq. Menth. Virid. ℥vij. M.
Capt. cochl. larga ij. quaque tertia horâ donec alvus bene responderit.

As a local application, I have found the following lotion beneficial :—

℞ Ammon. Hydrochlor. ʒiss.
Sp. Vini. Rect.,
Liq. Amm. Acet. āā. ℥ij.
Aqua Destil. ℥iv.
M. Ft. lotio sæpe applicand.

If the inflammation be not subdued by these means, and the vessels of the scrotum appear to be congested, they must be opened with a lancet, and the bleeding promoted by warm fomentations: the patient should likewise be kept in a recumbent position, and made to abstain entirely from animal food.

Should the orchitis be concomitant with gonorrhœa, and the discharge had ceased upon the swelling of the testicle, its return must, if possible, be produced, and with this object warm fomentations should be applied, not only over the scrotum, but also to the perineum and penis; and it will be generally found that if the purulent discharge can be again brought on, the inflammation in the testicle will rapidly subside. Many surgeons are sceptical with regard to the metastasis from the urethra to the testicle in gonorrhœal inflammation, but I have so frequently witnessed this phenomenon, that I have no doubt whatever on the subject. When the discharge from the urethra is re-established, and the orchitis subdued, I have found calomel and opium at bed-time the most effectual means of preventing the return of the disease.

Rheumatic subjects appear to be predisposed to a peculiar description of orchitis, which seems to attack the tunica albuginea: this form of the disease may be diagnosed by its commencing without any apparent exciting cause, if we except the rheumatic tendency of the patient; the disease generally yields without difficulty to the administration of alkalies and a small dose of colchicum at bed-time. Individuals of gouty diathesis are also liable to a somewhat similar affection. I had a gentleman for many years under my care, in whose case the attacks of gout were frequently preceded by discharge from the urethra and swelling of the testicle, without his having subjected himself to the possibility of venereal infection.

It sometimes happens, after acute orchitis has been subdued, (whatever its origin may be,) that the enlargement and hardening of the testicle remain, unattended, however, by pain or uneasiness: this induration is usually readily removed by the application of the following ointment:—

℞ Ung. Hydrarg.
Cerat. Saponis, āā. ℥ij.
Camphoræ, gr. v. M.
Ft. unguentum.

The ointment should be spread upon lint, strips of which should be laid smoothly over the swelling, and confined by adhesive plaister applied so as to maintain considerable pressure upon the parts. Some practitioners have recommended pressure as the most effectual means of subduing the swelling from acute inflammation in its early stages, but I do not advocate the practice, excepting as a secondary mode of treatment.

Chronic orchitis.—This subacute kind of inflammation sometimes supervenes on an acute attack, owing to the antiphlogistic means employed not having being sufficiently powerful to overcome the disease. The complaint may, however, commence under the chronic form, especially in persons of strumous constitution. The symptoms are very similar to those in acute orchitis, but they are more indolent, and tenderness rather than pain is described by the patient, the sensation of uneasiness extending along the course of the chord, and being not unfrequently attended by nausea. The mildest antiphlogistic remedies should alone be had recourse to when the disease has put on the chronic form, but if the veins of the scrotum be distended, two or three ounces of blood may be taken from them for the purpose of relieving the congestion; and I have known a good effect produced by dry cupping in the loins. The constitutional treatment consists in giving support to the powers of the patient, and if there be indications of a strumous diathesis, the iodide of potassium will be found useful. Sulphate of quinine is also an excellent medicine in these cases, and nutritive diet and change of air tend greatly to the restoration of the patient. Gentle pressure upon the diseased testicle will sometimes promote the absorption of the adventitious matter, but care must be taken to support the testicle effectively by a suspensory bandage. In strumous chronic orchitis there is a tendency to the effusion of the tubercular deposit; it fills up the interstices of the tubuli seminiferi, and completely destroys the general appearance of the secreting structure of the testicle. This matter is sometimes found deposited in distinct tubercules, and sometimes pervading the whole substance of the gland, as well as that of the epididymis itself. Both testicles are occasionally affected at the same time with this complaint,—a condition highly indicative of a strumous tendency; in such cases the comparative absence of pain, the slowness of the development of the disease, the temperament of the patient, the absence of venereal taint, and the insidious manner in which the attack commences, as well as the physical conditions of the swelling, are all points which enable the surgeon to form his diagnosis without much difficulty or uncertainty. The mode of treatment I have recommended may, however, prove insufficient to remove the disease, which may continue progressively to advance, and the tubercular deposit to disintegrate and suppurate. If this be the case, the skin of the scrotum becomes red and swollen, although there is still but little pain; spots of ulceration through the skin become evident, pus issues from the openings, and *chronic abscess of the testicle* is established. Shortly after matter has escaped, granulations are thrown out from the ulcerated spots, and quickly run one into the other until a large mass of granulation results; this puts on very much the appearance of fungoid disease, although, in fact, there is nothing malignant in its character. Within the last forty years, extirpation of the testicle in this affection was common, under the erroneous idea that it was a malignant disease, but at present the testicle is never removed under such circumstances. Various plans have been proposed for the removal of these granulating masses,—caustic, excision, and ligature, have severally been employed,—but in my own practice I have for the last eight or ten years given the preference to constitutional remedies; and although mercury may appear to be little indicated in these strumous affections, I have certainly found it most efficacious. The following is the form in which I administer it:—

℞ Pil. Hydrarg. gr. iij.
Potass. Iodid. gr. iij.
Pulv. Doveri, gr. v. M.
Ft. pilul. ij. nocte maneque sumendæ.

At the same time that this medicine is employed, black wash should be applied to the surface of the granulations. In some cases I have placed a ligature around the tumour to produce sloughing, but I prefer the medicinal means above described, as they improve the constitutional powers, and thus cure the local disease. When excision is performed for the removal of the granulations, the skin adherent to the base of the tumour should be dissected off, and the edges brought together by suture. When escharotics are employed, sulphate of copper, nitrate of silver, and even arsenic, are sometimes made choice of, but I do not consider these merely topical applications of much avail, as they war against the symptoms only, and do not attack the cause of the disease.

The following cases will, I trust, serve to illustrate and support these views. Patrick Sullivan, æt. 22, a married man, of strumous and unhealthy appearance, by trade a tailor, was admitted into Guy's Hospital, with a large granulating excrescence, growing from the testicle. About ten days before his admission, he consulted a medical practitioner, who placed a ligature around the excrescence; but this occasioned so much pain and irritation, that it was obliged to be removed. Under these circumstances, I at first considered it advisable to extirpate the testicle; but as the man was then in an unhealthy state, I thought it necessary that, previous to the operation, he should be placed under a course of medical treatment, particularly as there appeared about his person some eruptions, which created a suspicion of the disease having a syphilitic origin. He was accordingly ordered—

℞ Potass. Iodid. gr. iij.
Decoct. Sarsæ co. ℥iss. M.
Ft. haust. ter die sumendus.

℞ Hydrarg. c. Creta, gr. iij.
Pulv. Doveri, gr. v. M.
Ft. pil. omni nocte sumenda.

In consequence of his peculiar idiosyncrasy, his constitution became rapidly affected by the mercury, and in the course of a few days he was completely salivated; for this he was treated in the usual way, with astringent gargles, and gentle laxatives; but, unfortunately, at this time an attack of erysipelas in the face supervened: acupunctures were freely made over the affected surface, and ammonia and cascarilla administered, warm-water dressing being also applied to the face: under this treatment the patient rapidly recovered, both from the erysipelas and from the effects of the mercury; and upon re-examining the testicle, which had been neglected during the more urgent affections, it was found to be quite cured, the whole excrescence having disappeared. Tonics, with an occasional opiate at bedtime, were now ordered, to keep up his strength; and he rapidly regained his health, and soon left the hospital perfectly cured.

In another case, an officer in the army called to consult me for a disease of the testicle, which he stated to have existed for more than two years. Although the pain was never very great, the constant irritation had produced a considerable diminution of the constitutional powers; and within a short time of his visit to me, he had become much alarmed by what he described as the testicle "bursting and turning inside out."

I ordered him to take blue pill and iodide of potass., and to employ the black wash as a local application; also to restrict himself to the recumbent posture, and to use a somewhat generous diet. Under the influence of the blue pill his mouth soon became affected, and the granulations, which were exuberant on the testicle, subsided almost to a level with the skin; indeed, the improvement which took place was so great, that I considered him nearly convalescent, and I consequently stopped the mercurial remedy, and thought it advisable to substitute tonics. No sooner, however, had the ptyalism ceased, than the granulations on the testicle again became exuberant, and the patient complained of an uneasy sensation extending along the vas deferens to the urethra. Upon now questioning him closely, for the purpose of eliciting the circumstances attendant upon the commencement of the disease, I learned that he had always had some difficulty in passing his water: I considered it therefore proper to introduce a bougie to ascertain the state of the urethra, when I discovered a stricture. I placed him under treatment for the cure of this; and during the time required to re-establish the normal condition of the urethra, the testicle completely healed.

A testicle which has once been subject to disease of the above kind is never after capable of performing its natural functions; and, therefore, if any permanent neuralgic suffering remain after the granulations have been cured, it is better that it should be at once extirpated.

Capt. P—, thirty-three years of age, a married man, of strumous diathesis, and of intemperate habits, came to consult me, and gave the following history of his complaint:—He stated that while riding in the Park, about twelve months before, his horse started, and threw him forward on the pommel of the saddle, giving him a violent blow on the right testicle: this produced an attack of orchitis, which was treated with leeches, warm fomentations, and aperient medicines. The acute inflammation of the testicle was relieved at the time by these means, but the organ itself remained very much hardened; and in the course of about three months the pain returned, accompanied by rigors, and an abscess formed in the scrotum, and discharged a large quantity of very offensive matter. This discharge continued for about six weeks, when he observed a granulating tumour protruding through the openings of the abscess. At the time this gentleman applied for my advice, the tumour had attained the size of a hen's egg, the surface having a convoluted character, and being covered by a puriform secretion. I ordered the following medicines:—

℞ Pil. Hydrarg. gr. v.
Potass. Iodid. gr. iij. M.
Ft. pil. omni nocte sumenda.

℞ Hydrarg. Bichlorid. gr. j.
Ext. Sarsæ, ʒij.
Decoct. Sarsæ, ℥viij. M.
Capt. cochl. larg. ij. bis quotidie.

Black-wash poultice being at the same time applied to the scrotum.

In a week after commencing these medicines, his mouth became affected, so that I thought it advisable to diminish the quantity of mercury. An evident improvement in the diseased testicle also took place as soon as the ptyalism appeared; and by following this system of treatment, at the expiration of two months the patient was completely restored to health.

It not unfrequently happens that protracted chronic inflammation leads to an

Atrophy of the testicle, owing to the interstitial absorption, not only of the scrofulous deposit, but also of the natural structures of the testicle itself. Atrophy sometimes, however, occurs as a primary defect, from arrest of nutrition, and may therefore arise from various causes: if it be congenital, the cause of the defective nutrition is inexplicable, and beyond the reach of medicine, and must, I think, be dependent upon a peculiar diathesis. I have observed, in children who have been the subjects of mesenteric disease, that the testicles are very slowly developed; but this, perhaps, arises from physical obstruction to the vessels of the spermatic chord. It is said, that the mumps (cynanche parotidea) often lead to wasting of the testicles, and also of the mammæ in young women; and this effect is attributed to a metastasis of inflammation. I have never, in my own practice, met with such a case, neither have I ever known wasting of the testicle to follow orchitis caused by the extension of inflammation from the urethra: when urethral inflammation thus extends itself, it is the epididymis alone which is affected; but when the inflammation originates in the body of the testicle, either idiopathically, or in consequence of a blow, I have known wasting to be the result, and am therefore led to believe that the atrophied condition can only proceed from disease of the secreting portion of the testicle. Affections of the nervous system have been regarded as a cause of wasting of the testicle; and cases are recorded in which this description of atrophy has come on after injury to the head or spinal marrow. A case is mentioned by Mr. Curling, of a complete wasting of the genital organs and loss of virility, following a severe blow on the head received in battle by a soldier of the "Spanish Legion." The Baron Larrey also describes similar cases.

In the treatment of atrophy of the testicle little can be done beyond adopting those measures most conducive to the improvement of the general constitutional powers of the patient; in addition to the adoption of medicinal remedies, he should be removed from every source of excitement and irritation, and perhaps there is nothing more beneficial than a sea voyage.

The condition in which the testicle is left after atrophy is technically described by surgeons as the "fibrous testicle:" I believe it results from the total interstitial absorption of the gland itself, leaving merely its membranous investments. Some surgeons believe, that a fibrous tissue becomes morbidly developed, and that the peculiar state of the organ does not arise alone from the presence of the *débris* of the original structure. The cases I have seen do not to my mind support this view, but have rather shown that the effect is produced by the entire absorption of the tubular structure of the testicle. There can be no doubt, however, that such an abnormal development of fibrous tissue may occur, constituting a true fibrous tumour.

Irritable testicle.—This disease is often followed by atrophy of the gland, and is, indeed, sometimes premonitory of that condition; but it also not unfrequently occurs as a primary affection. It is indicated by great tenderness of the testicle, occasionally of both, but I have generally seen it in the testicle on the left side: the tenderness increases under exertion, or from the slightest pressure, so that even mere contact of the dress produces the most intolerable pain, extending along the groin to the back; restriction to the recumbent posture being the only means of obtaining relief.

Such an attack is often only of a temporary nature, more especially when it depends, as it may do, upon the excitement of great sexual desire, without gratification. Under these circumstances, a dose of tartarized antimony and hyoscyamus, with the application of an evaporating lotion to the scrotum, will generally be found sufficient to remove the symptoms; but the disease sometimes assumes a much more important and unmanageable form: the pain continues unmitigated by the medicines employed, the health becomes impaired, and the stomach extremely irritable; the general health is so much disordered, and the patient feels altogether so unfit to pursue his ordinary occupations, as to be willing to submit to any system of treatment which promises a chance of relief.

Sir Astley Cooper, at the urgent desire of the patients, has, in three cases of this disease, extirpated the testicle. The cases I have met with in my own practice have not been of so severe a character; and in three or four instances I have succeeded in removing the disease by attending to the restoration of the natural functions of the body, particularly those of the organs of assimilation. The state of the urine should always be carefully examined in this disease, as a deposition of its constituents might in itself cause irritation along the urethra, and produce severe neuralgia of the spermatic chord. I have usually found tenderness along the spine concomitant with irritable condition of the testicle, and blisters on the spine will in that case prove very beneficial. Iodide of mercury, combined with opiates, is also useful; but depletion of every kind must be avoided, as it increases irritability in proportion as it diminishes the constitutional powers. If, in the treatment of irritable testicle by quinine, steel, change of air, and alteratives generally, the remedies fail in producing a removal of the disease, it seems to me that the case must be looked upon as one of morbid sensitiveness of the nerves of the part, constituting, indeed, a true case of neuralgia—an affection which is as intractable here as in other parts of the body.

Syphilitic orchitis.—This is a rare disease, and when it occurs, very difficult to diagnose, as the patient describes symptoms which invariably accompany and indicate orchitis, whatever may have been its cause. The surgeon is, therefore, led to use such remedies as are generally employed in ordinary inflammation of the testicle; but these would be found quite unequal to the removal of the syphilitic form of the disease, although they may effect some alleviation of the symptoms, and the moment the treatment is stopped the disease will return as violently as before. This should induce a strict examination into the circumstances under which the inflammation commenced, and also as to the symptoms at the time,—as, for instance, whether the pain in the part increased at night—whether the patient had had any syphilitic taint—and whether discharge from the urethra had been a precursor to the attack; for a purulent effusion frequently exudes from a chancre within the urethra, which may have escaped the notice both of the surgeon and the patient, or which may, perhaps, have been mistaken for gonorrhœa. The fauces should also be examined for signs of secondary symptoms, and the surface of the body, especially about the back of the neck, for secondary cutaneous eruptions. If such indications be discovered, there is reason to suppose that the inflammatory condition of the testicle depends upon this specific cause, and in that case mercury will be found as effective as in any other form of syphilitic disease. I had a patient in Samaritan's ward, who was admitted with what was considered to be gonorrhœal discharge, but without the presence of the usually acute characters of that disease. I passed a bougie smeared with the Ung. Hydrarg. Nitratis and Ung. Cetacei into the urethra: this diminished the discharge, but shortly after the patient was attacked by orchitis, which I at first attributed to the irritation caused by the bougie and ointment. But as the pain and swelling of the testicle did not give way under the usual remedies, and as sore-throat soon supervened, I was led to consider this a case of syphilitic orchitis, and at once placed the patient under the influence of mercury, by which he was rapidly cured.

I believe this was a case similar to those described by Ricord, of chancre within the urethra,—a disease frequently mistaken for gonorrhœa, merely on account of the discharge from the urethra; and, as it is not treated as syphilis, secondary symptoms supervene: this is considered anomalous, because no primary sore was detected, and the affection seems involved in mystery, merely because the nature of the case is not thoroughly investigated.

MALIGNANT DISEASES OF THE TESTICLE.

With the exception of the breast in the female, the testicle is more liable to undergo the specific deterioration termed malignant, than any other secreting organ. The existence of malignant disease is usually at first more recognisable by the cachectic appearance of the patient, than by any peculiar physical characters in the disease itself. And the importance of this indication is so firmly impressed on my mind, that as soon as a patient consults me upon a disease of the testicle, I at once direct my attention to the expression of his countenance, placing considerable reliance on the guidance afforded by the peculiarity of his aspect. The most frequent of the forms assumed by malignant affection of the testicle is—

Medullary sarcoma.—This disease is similar to fungus hæmatodes in other parts of the body: it is sometimes termed soft cancer, and this is, I think, a very appropriate name, as the only difference between it and the affection often called hard cancer, depends upon peculiarities in the constitution of the individual who is the subject of the disease. In the sanguineous and youthful patient it is liable to put on the medullary character, while in persons past middle age, and of diminished vital power, it more frequently takes a more or less carcinomatous form. When this disease attacks the testicle, the swelling will at first preserve the form of that organ, but as it advances, the tunica albuginea gives way, owing to ulceration, and it will be found that the scrotum is distended on the diseased side into a large irregular tumour, the skin of which is very much discoloured, and numerous congested tortuous veins run over its surface. At the commencement of the disease, the body of the testicle begins to enlarge and become hardened, attended with a dull heavy pain and tenderness. The growth of the diseased mass proceeds irregularly, sometimes advancing with great rapidity, especially under the influence of any exciting cause; at other times its progress is extremely slow. As the tumour increases in size its surface becomes more uneven, harder in some places than in others, being indeed so soft in spots as to give the sensation of fluctuation. The pain in this disease is neither severe nor constant, and is rather of a dull heavy character than acute, the chief inconvenience complained of by the patient arising from the increased weight of the part, which produces an uneasy sensation, especially when the testicle is allowed to remain suspended by the spermatic chord.

Ultimately the disease extends in the course of the absorbent vessels of the chord to the lumbar glands, pain in the loins consequently forms one of the later symptoms, being a proof of the propagation of the disorder.

The exciting cause of this complaint can seldom be pointed out by the patient; it being probably attributed by him to exposure to cold or some slight external injury. It advances with great rapidity, particularly at the points which are soft and appear fluctuating, and the irregularity in the form of the tumour increases with its growth.

If a puncture be made into one of the softer parts of the swelling, a dark-coloured sanious discharge immediately follows, and in a few days a large fungoid growth springs from the puncture, and becomes developed with immense rapidity. If, on the contrary, no opening be made in the tumour, the skin ulcerates spontaneously, and the disease advances much in the same manner as when it has been punctured. The scrotum will bear considerable distention before it ulcerates, but when the tumour has attained a large size, it becomes adherent, ulceration sets in, and an open fungous mass protrudes. This, like other fungoid growths, increases very quickly, spreading on every side, sloughing at the surface, and occasionally bleeding profusely. The spermatic chord is often implicated in the disease, and in advanced stages of the complaint, large bodies of a dense fibrous substance, originating in disease of the lumbar glands, are found on the sides of the vertebræ, reaching as high up as the diaphragm. The circulation through the vena cava is sometimes completely obstructed by the pressure from these glandular masses.

At this stage of the disorder, the constitution becomes daily more and more implicated: the pain in the loins increases, the lower extremity on the diseased side becomes œdematous from the pressure of the lumbar glands upon the lymphatics; and sometimes, in the later stages of the complaint, acute pain, attended by spasmodic contractions of the testicle, is experienced along the course of the spermatic chord; loss of appetite, restlessness at night, profuse perspirations, and in some cases repeated hæmorrhages, constitute the fatal climax of the disease.

Fungoid disease of the testicle may occur at any period of life: cases are known in which an operation has been performed, for its removal, on children of one, three, and five years of age: in such instances it has been found, however, that the whole system partook of the peculiar taint, and the patients died shortly after the operation, giving evidence of malignant development in other organs. In one case I have known it to have been congenital, and a model of the enlarged scrotum of the child at the age of ten months, is in the museum of Guy's Hospital. The disease usually appears, however, in the middle period of life, but, as I have said, no age is free from its attacks.

The *diagnosis* of medullary sarcoma in its early stage may sometimes be attended with difficulty, and the disease may be mistaken for hydrocele, hæmatocele, sero-cystic disease of the testicle, or strumous abscess. The want of transparency, acute pain, irregularity of the surface of the tumour, and absence of the pyramidal form, together with the impaired constitutional vigour of the patient, serve, however, to distinguish medullary sarcoma from hydrocele. To distinguish fungoid testicle from sero-cystic is much more difficult; in both these diseases there is found a similar irregularity of surface, rapidity of growth, and alternating hard and fluctuating points in the mass of the tumour; indeed, in both, the physical conditions are so similar, that the most experienced surgeon may find it difficult to distinguish one from the other. In sero-cystic testicle, however, the constitution remains unaffected; but perhaps the most certain distinctive indication is obtained by puncturing one of the most fluctuating points of the swelling: in medullary sarcoma, a bloody discharge, mixed with brain-like matter, is the result, while in the sero-cystic disease nothing but a limpid or sanious fluid escapes. The malignant affection may be distinguished from strumous abscess chiefly by the history of the case, and the train of symptoms that were premonitory of the ulceration in the scrotum, and also by the discharge of pus, if the part be punctured, instead of the production of the fungoid growth which always springs from an opening made in a medullary sarcoma. The treatment of the malignant disease is as yet wholly empirical, and is directed more towards the alleviation of symptoms than to the radical cure of the disease, which, indeed, in the present state of medical science, appears hopeless. Iodide of potassium, iodine, mercury, arsenic, with bark and other tonics, have all proved ineffectual; local applications seem also to be without effect, excepting, perhaps, that they check the rapidity of the growth of the fungus: nothing is therefore left, to afford a chance of life, but extirpation of the tumour; but even this alternative should not be adopted where there is reason to believe that the lumbar glands are implicated in the disease, or that it has extended up the spermatic chord, beyond the internal abdominal ring; indeed, when the operation is performed under the most favourable circumstances, the disease generally proves ultimately fatal. I have myself never known a case in which it did not return after operation, either in the spermatic chord or in the lumbar glands.

When a testicle affected with medullary sarcoma is dissected, it is found to contain an adventitious mass of brain-like substance, which fills up the tubular structure of the organ: this newly formed matter is partly organized, but a portion of its substance seems incapable of receiving bloodvessels for its nourishment, but transmits their branches, which merely pass through the mass without being connected with it, and have the appearance of being distended for want of support from the surrounding tissue. These vessels readily give way under ulceration; an effusion of blood then occurs, giving to the tumour a character of great vascularity. Upon more careful dissection, it will be discovered that the brain-like matter is contained in small cysts of greater or less density, according to the nature of the effusion. Some of these cysts contain sanious fluid, others a substance having the appearance of a mixture of a creamy matter with more or less blood, and others again more solid matter: it is this variety in its contents that gives to the tumour externally its irregularity of figure and consistence, in which respect it resembles so closely sero-cystic testicle, as to be, as I have already described, with some difficulty distinguished from that disease. Some time since, I was requested to go down into Bedfordshire to see a patient of Mr. Williamson, of Sharnbrook, in a case of disease of the testicle. The physical conditions were precisely such as to lead to the supposition that it was sero-cystic disease: the slight constitutional disturbance in this instance also seemed to confirm the belief that it was not malignant. Extirpation of the testicle was proposed to the patient, but he could not at once make up his mind to submit to the operation; during this delay, the true nature of the disease became completely established, as his health suddenly failed, and his appearance became strongly cachectic: he was now very desirous that the operation should be performed, and the testicle was accordingly removed. The disease in this case returned about three months after the operation, in the cicatrix and truncated extremity of the spermatic chord, and within a year and a half the patient died.

Although the result of operation in this disease is rarely successful, still it may be the means of lengthening life; and as the extirpation is not in itself dangerous, it is difficult to withhold from a patient this last and indeed only chance of obtaining cure, or at least some mitigation of suffering.

LECTURE LI.

CONTINUATION OF DISEASES OF THE GENITAL ORGANS.

Malignant disease of the testicle—Scirrhus of the testicle—Case—Sero-cystiform disease of the testicle—Diagnosis—Non-descended testicle—Operation of castration—Wounds of the scrotum—Case—Diseases of the spermatic chord—Varicocele—Diagnosis of—Treatment—Sir Benjamin Brodie's operation—Ricord's ligature—Sir Astley Cooper's operation—Operations seldom effective—A similar disease sometimes occurs in the round ligament of the uterus—Hydrocele—Varieties of hydrocele—Diagnosis of—Treatment—Spontaneous cure—Case—Surgical treatment—Incision—Cases—Excision—Caustic—Seton—Ricord's modification of the seton.

Scirrhus of the testicle.—True scirrhus of the testicle is very rare—that is, if the term be used to indicate that malignant affection so frequent in the breast of the female, and called hard cancer. It is not, however, unusual to meet with a hard enlargement of the testicle after orchitis; and this, if existing in a cachectic diathesis, may probably be mistaken for true scirrhus, but I have myself never known such a condition go on to ulceration, having the hardened everted edges and other characteristics of true cancer. In this hardening of the testicle, the skin remains intact, the mass becomes tuberculated, and acute pain, extending up the chord, is often experienced by the patient. I extirpated the testicle for a gentleman who was suffering from this disease, which would neither yield to constitutional nor local remedies: upon dissection of the tumour, the secreting structure of the organ was found entirely changed, nothing like tubuli seminiferi remained, and the whole constituted a mass divisible into lobes, unequal both in size and consistence, some being almost cartilaginous. The tunica albuginea was also thickened; the wound healed shortly after the operation, and the patient (although the tumour was removed six years ago) continues perfectly free from any symptom of its return. There is, however, no doubt, a kind of disease so far resembling scirrhus, that it does sometimes return, but not being propagated through the medium of the absorbents to distant parts, it cannot be considered as a malignant disease, but merely one which has a tendency to develope itself, although innocent in its nature.

Sero-cystiform disease of the testicle.—Sir Astley Cooper distinguished this disease by the term hydatid testicle, but as the cysts do not contain animalculæ, the name is incorrect. The swelling in this complaint is irregular in form, fluctuating in some parts of its surface, whilst it is solid in others, so far (although not a malignant affection) resembling medullary sarcoma: the best means, perhaps, of distinguishing between the two, consists in puncturing one of the softest parts of the tumour, when, if it be a sero-cyst, a limpid fluid will be poured out, while in medullary sarcoma a semi-fluid sanious matter exudes. I believe it has never been ascertained whether the fluid of the sero-cyst contains spermatozoa: I am inclined to expect that this may be the case; if so, a further and very certain diagnostic mark of the disorder would be obtained. This condition probably originates in obstruction and dilatation of the tubuli seminiferi, just as a disease of a similar character is produced by the obstruction of the lactiferous tubes in the mammary gland; it belongs, therefore, to that order of cystic formations which arises from dilatation of natural excretory ducts.

In the sero-cystiform disease of the testicle the tumour increases rapidly, but not so much so as in malignant affections: in the former, however, there is no constitutional disturbance, while in the latter the health of the patient is invariably very much disordered.

I am disposed to regard sero-cystiform disease of the testicle as a modification of encysted hydrocele; I think it might properly be termed "internal encysted hydrocele of the testicle." In the diagnosis of this disease it is sometimes difficult to distinguish it from hydrocele, or medullary sarcoma; but the irregularity of the surface of the tumour, with the absence of the pyramidal form and transparency, is generally sufficient to mark distinctly the difference between it and hydrocele; and, in addition, the great weight of the swelling, and the unequal consistency of its surface, indicate positively that it contains solid as well as fluid matter: nevertheless, the best surgeons have fallen into error on this subject, and have plunged the trocar into a sero-cystiform testicle, mistaking it for hydrocele of the tunica vaginalis. If the disease be of long standing, the septa of the tubuli seminiferi which spring from the tunica albuginea may have become much thickened, and give the tumour a more or less fibrous character, in addition to those of a common sero-cyst. A section of a testicle affected by this disease displays numerous cysts dispersed through the substance of the swelling, varying in size from that of a pin's head to that of a pigeon's egg: the appearance of these sections is precisely similar to that of a mamma under the same disease; and without using the microscope I do not think it would be possible to distinguish one from the other.

Neither constitutional nor local treatment seems to possess any power to arrest the progress of this disease, and nothing but its extirpation can relieve the patient: the operation may, however, be undertaken with confidence, for the disease is not propagated by the absorbent system, nor is the patient liable to its return, as it is not malignant, and does not interfere with the general health. The last patient on whom I performed the operation of castration was suffering from this disease; he recovered without any bad symptom, and has never since experienced any tendency to its return, either in the opposite testicle or truncated spermatic chord.

It sometimes happens that the testicles, instead of descending into the scrotum, remain either in the loins or in the inguinal canals: they may still be attacked by any of the diseases to which they are obnoxious when in the scrotum; their abnormal position must, however, to a considerable extent obscure the diagnostic marks of such disease; and, in consequence of the small portion of the spermatic chord exposed to examination, it is very difficult to ascertain whether that structure is implicated. The absence of the testicle from the scrotum would indicate the nature of a swelling in the inguinal canal, especially as all the usual symptoms of disease of the testicle would be present, and therefore the extirpation of the organ would be as necessary here as when in its natural situation.

Operation of castration.—The removal of the testicle from the scrotum is generally a very simple operation; it is performed in the following manner:—The patient is placed on a table of convenient height, and the pubes being shaved, the surgeon commences his operation by making an incision a little above the external abdominal ring, continuing it downwards through the skin, dartos, fascia spermatica externa, and cremaster muscle: the operator next takes hold of the spermatic chord between the finger and thumb of the left hand, and having separated the vas deferens from the spermatic vessels, (which may be easily done from the peculiar whip-cord feel of the vas deferens,) a needle armed with silk is passed under them, and the ligature is held by an assistant, to prevent the retraction of the chord. The chord is then divided below the ligature, and the sound testicle, together with the septum scroti, being drawn aside by an assistant, the surgeon with a few sweeps of the knife separates the diseased organ from the loose cellular tissue which connects it with the scrotum. It is recommended by some surgeons, that instead of *dissecting* out the testicle, it should be removed with the skin by one sweep of the knife, leaving only the sound half of the scrotum; but as this operation produces a much greater degree of mutilation it is seldom had recourse to, although it certainly possesses this advantage, that it removes the liability to the formation of matter in the loose skin left in the other operation.

When the testicle has been removed, the spermatic artery must be tied, and then the ligature placed round the vessels at the commencement of the operation may be withdrawn; this ligature is, however, of great service during the course of the operation, as when the chord is divided the ligature prevents its retraction into the inguinal canal. The artery of the vas deferens, as well as that of the septum scroti, should be secured to prevent secondary hæmorrhage, and the consequent necessity for reopening the wound after the patient has become composed in bed; indeed, on account of this tendency to after-bleeding, the wound ought never to be closed until some hours after the operation.

To show the importance of the ligature round the spermatic vessels in preventing the retraction of the chord after division, I relate a case in which this precaution had not been taken, and in which a dangerous secondary hæmorrhage ensued. A military surgeon at Woolwich had removed the testicle of a marine, and on the division of the chord it retracted into the inguinal canal; the blood-vessels of the scrotum were secured, and the patient placed in bed. An hour after, the surgeon was sent for, severe bleeding having come on; he could, however, find no bleeding vessel, and applied pressure and cold; but these were insufficient to check the bleeding, and I was sent for. Upon examining the patient, I found that the blood issued from the external ring; I therefore proceeded at once to lay open the inguinal canal, and, exposing the spermatic chord, secured its artery, and prevented further hæmorrhage. I have also frequently found it necessary to reopen the wound after extirpation of the testicle, in consequence of the small artery of the septum of the scrotum not having been secured; as this vessel, notwithstanding its minuteness, cannot be safely left without a ligature. When the testicle remains within the inguinal canal, and from any circumstance requires extirpation, the operation is performed by cutting through the skin and superficial fascia, above Poupart's ligament, in the direction of the long axis of the tumour, exposing the tendon of the external abdominal oblique muscle, which must be divided: the inguinal canal is thus laid open, and the diseased testicle, covered by the fascia spermatica interna, may be seen. The chord must now be divided, and secured in the same manner as above described; and the testicle removed, with similar precautions.

A wound of the scrotum may sometimes render it necessary to tie the spermatic artery, in order to suppress hæmorrhage. The following is an instance of this kind:—A bargeman, aged twenty-one, was brought into Guy's Hospital, in consequence of a severe injury to the scrotum. In jumping down into his barge, he fell upon the handle of a broom, which, penetrating the scrotum, produced a deep lacerated wound, through which the testicle partly protruded. When brought into the hospital, the patient was in a state of collapse; his countenance blanched; the surface of his body cold; and his pulse scarcely to be felt. Hot water was ordered to be applied to his feet, and stimulants given to promote reaction. The circulation was no sooner re-established than a profuse hæmorrhage came on; and upon seeking for the source of the bleeding, it was discovered that the spermatic artery was wounded. Upon returning the testicle, and examining the depth of the wound, it was found to extend about four inches upwards, to a space midway between the anterior and superior spinous process of the ileum and the umbilicus, where a hard substance could be felt. I immediately made an incision into this part, and, after cutting through the skin and superficial fascia, removed a large piece of his plush trowsers, which had been driven into the wound, and secured the bleeding artery. This man ultimately recovered, but slowly, owing to the large quantity of blood which he had lost.

DISEASES OF THE SPERMATIC CHORD.

Varicocele is the term technically used to designate dilatation of the veins of the spermatic chord. This disease is most frequent in the veins of the left spermatic chord—a circumstance which arises partly from the more depending position of the left than the right testicle, and partly from the pressure of the sigmoid flexion of the colon retarding the flow of blood from the left spermatic to the emulgent vein. When the course of the blood through a vein is impeded, the vessel naturally becomes distended, and its valves are rendered incapable of performing their office of dividing the column of blood; the vein has, consequently, to resist the weight of a column of fluid equal in length to itself; and having to support an abnormal amount of pressure, it becomes distended, and frequently inflamed. Nature remedies this defect, by rendering a vein in this condition tortuous in its course; thus compensating for the loss of valves by interrupting the directness of the vertical column. In this state the disease is termed varix, which may occur in any part of the body.

When this disease is seated in the veins of the spermatic chord, it may be distinguished by the peculiar feel of the swelling, which gives a sensation aptly compared by Sir Astley Cooper to that of grasping a bag of earth-worms.

The degree of distention of the veins varies at different periods, according to the length of time the person has been in the erect posture. On rising in the morning, there is scarcely any abnormal enlargement; at night the swelling is the greatest, and the uneasiness arising in consequence most severe. Attending this disease, there is usually more or less pain in the course of the spermatic chord, and sometimes an irritable state of the testicle is induced by the altered nutrition of the organ, leading to the necessity of maintaining the recumbent posture to relieve pain. At this stage of the disease the surgeon is generally consulted; and as the patient will state that he is the subject of a swelling in the groin, and probably complain also of a constipated state of the bowels, the first impression is very likely to be, that he is suffering from hernia. Upon placing him in the proper position for examination, a tumour will be found in the seat of inguinal hernia; by pressure this easily recedes, returning directly the pressure is removed: upon coughing it dilates. These are symptoms of hernia; but yet there are diagnostic marks so distinct, that no excuse can be made for mistaking one for the other: for instance, after the tumour has been pushed back, if the pressure be maintained, a hernial tumour cannot reappear, while the varicocele directly reappears below the point of compression; as by the pressure we add to the difficulty of the passage of the refluent blood towards the heart. I have met with some difficulty in the diagnosis, when varicocele has been complicated with hydrocele of the chord, which being concomitant with a constipated state of the bowels, led me to consider the irreducible tumour as strangulated hernia; but the restoration of the natural function of the bowels by purgatives, at once elucidated the nature of the case.

When the disease is ascertained beyond doubt to be varicocele, the means to be adopted for its cure naturally become the subject of the surgeon's consideration. If it be found that constipation of the bowels, and a loaded condition of the sigmoid flexion of the colon, be the exciting causes, their removal would immediately suggest itself as the best means of relief; and neutral salts, purgative enemata, recumbent posture, with cold applications, and support to the scrotum, will be generally found effectual in removing the immediate congestion of the veins. To render this benefit permanent, gentle aperients should be used habitually, and the scrotum kept supported by an elastic suspensory bandage. Where the disease is of a more obstinate character, these means will, however, be found insufficient; and various surgical operations have been recommended for the purpose of producing a radical cure, by the obliteration of the diseased veins: potassa fusa, has, for example, been employed to produce sloughing of the skin, and such an inflammation in the veins as will produce their obliteration. By some, division of the veins has been had recourse to; and I believe Sir Benjamin Brodie has been in the habit of dividing them in this disease, by means of a pair of very fine scissors passed beneath the skin, pressure being afterwards applied to prevent hæmorrhage. M. Ricord also recommends a subcutaneous operation; but instead of cutting the vein, he employs a most ingenious arrangement of ligature to effect its obliteration. To apply the ligature, he passes a needle armed with a double thread through the skin and beneath the vein, and a second needle with a similar ligature, inserting it into the opening by which the first had been brought out, passing it under the skin, but above the vein, and bringing it out by the opening which the first needle and ligature had made. The result of this operation is, that from each opening a loop and two free ends project. If these ends on either side be now passed through the loops respectively, and then drawn tight, the vein will be included in a most effective ligature, which may be secured over a piece of quill or bougie, to maintain the requisite pressure. If the inflammation resulting from the application of the ligature should be too great, the ligature may easily be removed merely by pulling at one free end on either side; the knot will then slip and the threads may be withdrawn.

On two or three occasions I have punctured the distended veins in varicocele, particularly where there has been much pain; and in such cases I have not only succeeded in relieving the congested state of the vessels, and the consequent pain, but have found that the veins subjected to this treatment became obliterated, so that at first I believed I had effected a permanent cure by this operation. Further experience has, however, taught me that, although by this plan one vein may be obliterated, others become enlarged, and, in fact, the relief is only temporary; and such, indeed, is the result of all the operations hitherto attempted for the purpose of rendering distended veins impervious to the blood.

These operations, although very simple in themselves, are sometimes followed by most dangerous symptoms—phlebitis occasionally supervenes; and numerous cases of death from this cause are on record. The operation should, therefore, never be undertaken without due preparation of the patient. Sir Astley Cooper recommended another form of operation. He conceived, that as in varicocele the scrotum is always much elongated, the veins became diseased in consequence of having lost their natural support; and he accordingly thought that if a large portion of the loose skin were removed, the support would be restored, and a permanent natural compress established. I have tried this plan of treatment myself, and the following case shows with what result:—The patient was a young farmer from the Isle of Sheppy; he had been for more than two years suffering from a varicose state of the veins of the left spermatic chord. The whole scrotum was nearly double its natural size, and the diseased side was so pendulous as to reach at least one-third lower than the opposite. The slightest touch produced considerable pain, both in the testicle and in the course of the spermatic chord; indeed, the symptoms were so urgent, that it was necessary to adopt some plan for the immediate relief of the patient, who had been subjected to every description of constitutional treatment without obtaining any benefit. I proposed in this case to excise a portion of the scrotum in the manner recommended by Sir Astley Cooper. The operation was performed as follows:—He was placed in the recumbent posture on the foot of the bed, and the distended veins of the left spermatic chord emptied of their contents; the relaxed skin of the scrotum was then drawn up tightly between the fore and middle finger by an assistant, the testicle being pressed closely against the external ring with the back of the hand. With a few sweeps of the knife I removed the whole of the restricted skin, exposing the tunica vaginalis, which was the only covering to the testicle. The edges of the skin were brought together and secured by suture, so as to form a close envelope to the testicle, and the parts were all well supported by adhesive plaister and bandages. A high degree of constitutional irritation followed the operation, and at one time the life of the patient was in considerable danger; but he ultimately recovered, and I sent him to Sir Astley Cooper, that he might see the result of his new method of treatment. He wrote me in return, the following note:—"The case of spermatocele you sent me is singularly gratifying to me; the operation has been more successful than in any instance in which I have myself performed it."

Notwithstanding the opinion thus expressed by Sir Astley, the benefit proved but temporary; for, two years after, the patient again came to me, the disease having returned, and it was necessary for him always to wear a suspensory bandage. One could scarcely believe that a truss could afford any relief in varicocele. I have, however, found that the application of what is called a "Mocmain" truss produces sometimes a very good effect. The advantage is perhaps attributable to the circumstance that the pressure prevents the column of blood above the truss from regurgitating into the spermatic veins; substituting to some extent the function of the venous valves. Sir Astley Cooper tried on dogs the effect of tying the spermatic artery, thinking that, by thus cutting off the chief supply of blood to the testicle, the veins might be relieved from congestion; but the experiment produced sloughing of the testicle, and therefore it was never attempted in cases of varicocele.

The female is not wholly free from a disease similar to varicocele, as the veins of the round ligament of the uterus are subject to dilatation. In the female, however, the disease is not by any means so obstinate as in the male: the swelling is chiefly seated in the labium pudendi, and is much more under the control of the surgeon; it might however, as in the male subject, be mistaken for hernia.

HYDROCELE.

Hydrocele is the most frequent of the diseases affecting the coverings of the testicle and chord; it is, indeed, as its name implies, caused by an inordinate secretion of the natural fluid of a serous membrane, and is similar to the effusions that are met with in the arachnoid, the pleura, the pericardium, and the peritoneum, which effusions constitute formidable diseases in the cavities to which those membranes belong.

The tunica vaginalis is a prolongation of the peritoneum, being brought down into the scrotum by the descent of the testicle. At first this serous cavity communicates with the great cavity of the peritoneum itself; but soon after the testicle has arrived at its ultimate destination in the scrotum, an adhesion takes place between the two surfaces at the abdominal rings, and the tunica vaginalis then constitutes a distinct serous bag. Occasionally this membrane becomes inflamed, either from blows or some other exciting cause: in the acute stage of the inflammation it may require antiphlogistic remedies similar to those employed for the treatment of simple orchitis; the inflammation will thus be very generally subdued, and terminate by what is called resolution. It may happen, however, that although the acute symptoms are relieved, a chronic inflammation may remain, leading to the secretion of an abnormal quantity of fluid in the interior of the sac, and in this condition consists the disease termed *hydrocele*. Such distinct inflammatory action may not, however, constitute the premonitory signs of the formation of hydrocele, and the collection of fluid very frequently takes place insidiously, unaccompanied by any symptom excepting enlargement. Under these circumstances, it is supposed that the defect occurs in the diminished power of the absorbents to act in unison with the capillaries; so that an accumulation takes place, from the equilibrium being lost between those two classes of vessels.

The disease occurs at all periods between infancy and old age, and is sometimes congenital; and again, although there may not be at birth any fluid within the tunica vaginalis to constitute hydrocele, a permanent communication between the tunica vaginalis and peritoneum may remain, rendering the individual liable at any time of his life to hydrocele, which, under these circumstances, must be still regarded as congenital.

Varieties of hydrocele.—Hydrocele appears under various forms; for instance, there may be simple hydrocele of the tunica vaginalis of the testicle, or it may extend along the spermatic chord into the peritoneal cavity, constituting *congenital hydrocele;* another variety, termed *encysted hydrocele,* may arise in connexion with the testicle itself: in this case, the accumulation of fluid is not within, but exterior to, the tunica vaginalis.

In simple hydrocele of the tunica vaginalis, there may be two or more distinct tumours, owing to the sac being divided by adhesive septa; I have myself been obliged to make two punctures to evacuate the distinct sacs. A further variety may exist from an unusual position of the testicle, which is commonly placed behind, and above the centre of the swelling. The liability to such varieties shows the necessity for careful investigation in every case before the surgeon proceeds to evacuate the fluid. Hydrocele of the spermatic chord may also form below the external ring, or between the two rings in the inguinal canal, and this may lead to considerable difficulty in the diagnosis. Moreover, any of these varieties of hydrocele may be complicated with hernia, diseased testicle, varicocele, or other diseases, which may render an exact estimation of the complaint extremely difficult.

Diagnosis.—Simple hydrocele of the tunica vaginalis of the testicle constitutes a pyramidal swelling, somewhat elastic, and presenting a uniform smooth surface. The patient describes that the swelling commenced at the lower part of the scrotum, and gradually increased upwards, being usually without pain. The chord is found quite healthy above, and not in any way implicated in the swelling, which it merely suspends. On examining the back part of the tumour, and producing pressure, the peculiar painful sensation produced by squeezing the testicle is experienced by the patient. The swelling does not dilate in the act of coughing. All these are signs of a hydrocele; but the chief characteristic has yet to be mentioned, viz. the transparency of the tumour. This is best seen by taking the patient into a dark closet, and holding the tumour between the eye and a strong light, when the transparency, if it exists, becomes quite obvious, and, from the opacity of the testicle, its position is also easily discovered. Transparency, however, is not always to be found as a characteristic mark of hydrocele; for the nature of the fluid, thickening of the tunica vaginalis, or œdema of the scrotum, may interfere to obscure it, and the surgeon, under such circumstances, must form his diagnosis from the history of the case, and from the other symptoms. Should there be any difficulty in ascertaining the true nature of the case, a small puncture may be made, which will remove all doubt, by producing the free escape of serum, if hydrocele exist. It is true that in œdema of the scrotum, serum would flow from such a puncture, but merely a drop; and in that disease, the form of the swelling, the history of the case, and the general anasarcous tendency in the patient, would preclude the possibility of confounding the diseases.

Treatment of hydrocele.—In young children, the cure of simple hydrocele, if not spontaneous, may generally be effected by local applications; and I have frequently produced absorption of the fluid by the use of the following lotion:—

℞ Amm. Hydrochlor. ʒj.
Liq. Ammon. Acet., Sp. Vini. Rect. aa. ℥ij.
Aqua Distil. ℥iv. M.
Ft. lotio sæpe applicand.

Should this treatment not succeed, acupuncturation is almost infallible in children.

In later periods of life, hydrocele sometimes undergoes a spontaneous cure, from a blow or any cause which induces inflammation, or from a rupture of the tunic, with diffusion of the fluid; I think I have also known it result from an altered action being established, without the tunica vaginalis being torn. A gentleman consulted me who had been the subject of hydrocele for two years, and had twice submitted to evacuation of the fluid by surgical operation. The fluid had, however, again accumulated; but on the day before he applied to me he had run against a post and struck the scrotum; this had produced considerable inflammation, but no sign of the bursting of the tunica vaginalis. I ordered antiphlogistic remedies, and recommended that he should remain in a recumbent posture; this led not only to the relief of the inflammatory action, but to my great surprise the fluid became absorbed, and the hydrocele was permanently cured.

If a surgical operation be requisite, incision, excision, application of potassa fusa, seton, tapping, or injection, are all at the disposal of the surgeon: the two latter are the means which are now generally adopted, but as they do not always succeed, the other means are occasionally had recourse to. Incision was employed by John Hunter; it was performed in the following manner:—He made an incision into the tunica vaginalis, allowing the fluid to escape, and then sprinkling flour on the surface of the tunic to excite inflammation, the membranous sac filled up by granulation. This operation, however, so frequently led to sloughing, that Mr. Pott substituted that of injection, which is now almost always employed. In cases, however, in which there is a great difficulty in forming a diagnosis, incision is a most safe mode of proceeding, provided no further means be employed to produce inflammation of the tunica vaginalis. In June 1839, I admitted a patient, aged 64, into Stephen's ward, Guy's Hospital, with a large scrotal tumour, which had formed so rapidly that I doubted whether it was hydrocele or hæmatocele; this doubt was increased by the perfect opacity of the tumour, and I proceeded therefore to open the tunic by way of exploration; a pint of brownish serum was evacuated, and I found the tunica vaginalis extremely thickened, in some parts cartilaginous, and at its upper portion ossified: the patient was, however, perfectly cured by this simple operation. My colleague, Mr. Cock, also treated a similar case by incision, but in that instance the whole cartilaginous tunic was thrown off by a sloughing process; this patient also recovered. I have had several cases in which I have adopted simple incision as the mode of treatment. I select the following, in addition to that already described:—

John King, æt. 50, was admitted in February into Stephen's ward; he was a temperate man, and in excellent health. About three years before, he received a blow upon the scrotum, which shortly after began to swell, but did not occasion much inconvenience until two years after the accident, when, in getting over a stile, he again struck the scrotum, and suffered severe pain for three weeks. After that time the part had increased in size with great rapidity, and when admitted into the hospital he was found to have hydrocele on the right side. He was tapped, and twelve ounces of serum, mixed with some blood, drawn off. After the operation, slight febrile excitement ensued; this, however, subsided, but the fluid reaccumulated. An incision an inch and a half in length was now made, to evacuate the fluid; the tunica vaginalis soon filled with granulations, and he was presented in June, perfectly cured. In Sir Astley Cooper's note-book, I find the following memoranda: —"I operated on a gentleman for hydrocele, from Barbadoes, by incision, in whom the tunica vaginalis was converted into a distinct cartilaginous bag, and divided into different cavities, some containing a glairy, others a purulent fluid: the cavity granulated, and the patient perfectly recovered."

"Mr. Forster, at Guy's Hospital, admitted a patient with a large opaque fluctuating swelling of the scrotum, which had resulted from a blow, and was attended with ecchymosis. He operated by incision, and a large quantity of extravasated blood was found in the tunic: the patient recovered." Mr. Forster had evidently considered this case a hæmatocele, and not a hydrocele, and properly treated it. "Mr. Chandler performed the operation for the cure of hydrocele by incision, and the introduction of lint dipped in oil —a usual practice at that time: a high degree of constitutional irritation was set up, and the patient died."

"A patient on whom Dr. Warren operated by incision and introduction of foreign matter into the tunic, for the cure of hydrocele, was afterwards seized with a violent attack of irritative fever, and died in consequence."

From these cases, therefore, it would appear that the operation by incision, for the cure of hydrocele, is not to be considered a safe one, or, at any rate, not with the introduction of any foreign substance into the tunica vaginalis to excite inflammation as a preventive to the recurrence of the effusion. Simple incision, I am sure, however, may be safely adopted in cases which offer a difficulty in ascertaining the precise nature of the disease.

The operation by excision has been adopted by some surgeons, in consequence of its having been found that the incision alone, without the introduction of some substance into the tunica vaginalis, was often insufficient to produce the degree of inflammation necessary to the permanent cure of the disease. The mode of operating by excision is, to cut down upon the distended tunic, puncture it with a lancet, and then drawing out a portion of the flaccid sac with a tenaculum, snip it off. This operation was recommended by Mr. Kinder Wood, as a modification of the older method of excision, which consisted in removing the whole of the tunica vaginalis; but both methods have been abandoned for years, being highly dangerous from the degree of inflammation they excited.

Operation by caustic was adopted at one time, potassa fusa being the escharotic employed. It was applied to the scrotum; and a slough being thrown off, and the tunica vaginalis exposed, it was then applied to that tissue until it penetrated and evacuated the fluid. This mode of treatment is equally tedious and severe, and has long since given way to safer and more certain modes of treatment.

The following cases, from Sir Astley Cooper's note-book, will prove that it was not always successful, even if it did not produce injurious effects:—

"Mr. Allen, chemical lecturer at Guy's, sent me a gentleman with hydrocele, whom Mr. Vance had attempted to cure with caustic; and although the patient had suffered much from its application, the disease returned. I injected this case with a solution of sulphate of zinc, and the patient was cured."

The second case, however, shows the danger of employing caustic:—

"Mr. Cline applied caustic in a case of hydrocele in an elderly gentleman; and in about ten days afterwards, when the inflammation was at its height, the patient died from the consequent irritative fever."

"I (says Sir Astley Cooper) lost two patients myself from submitting them to this mode of operation for hydrocele, and then thought it high time to give it up, and to adopt some safer method."

Operation by seton.—Mr. Pott frequently performed this operation, and seemed for some time to prefer it to every other, until, indeed, he substituted injection for it. I have myself, upon a few occasions, employed seton in hydrocele; but its use produced such alarming symptoms, that I have entirely laid it aside. The following cases will be sufficient, I think, to show the danger:—Mr. C—, of Great Marlborough-street, some years ago took me to see a patient who had three times ineffectually submitted to the injection of a hydrocele; I determined, therefore, upon making trial of the seton, and inserted it in the following manner:—Having drawn off the fluid in the usual way with the trocar and canula, I passed a long needle, armed with a strong double silk, through the canula. I thrust the needle out through the tunica vaginalis and skin, at the upper part of the scrotum. Eight hours after the operation, but little inconvenience had been experienced, and therefore the seton was allowed to remain. Next morning the inflammation was not beyond the desired extent; but being considered sufficient, the silk was removed. In the evening, the patient complained of great pain: the scrotum was considerably swelled and inflamed; the countenance anxious; and the pulse full and hard. Twenty leeches, and fomentations, were applied to the parts; and calomel and opium, with saline effervescent draughts, prescribed. The next morning I found my patient had been delirious all night; swelling of the scrotum much increased, and it was dark-coloured and ecchymosed; pulse 130; bowels freely opened. I made incisions into the swelling, ordered port wine poultice to be applied; to continue the calomel and opium, and to take a mixture, consisting of ammonia and bark; a free use of porter, or brandy-and-water, also to be permitted. The next day the whole scrotum was in a state of slough; the delirium had left the patient; his pulse was only 100; and from that time he gradually improved, and ultimately got quite well.

In 1833, I admitted a patient into Job's ward, who had been the subject of hydrocele for many years: he had three times had it injected, but without benefit. I passed a seton in the same manner as described in the last case. Violent constitutional symptoms supervened, and ended in suppuration; and the formation of matter was indicated by severe shiverings. I laid the tunica vaginalis open, and my patient ultimately recovered, but not without having undergone imminent danger of his life.

The following is a case in which abscess, as well as very urgent symptoms, supervened, upon the application of a seton:—Henry Cox, æt. 32, was taken into Naaman's ward, December 1836, with hydrocele on the right side; the swelling was about the size of a large pear. A seton was passed into the base of the tumour (without drawing off the fluid): the patient went on well for two days, when the part became very painful, much swollen, with quick pulse, hot skin, and parched tongue; in consequence of these symptoms, the seton was withdrawn. Nevertheless, the pain in the scrotum continued, and was followed by rigors, until a large abscess formed; a considerable quantity of matter was evacuated, the rigors ceased, and the symptoms of fever also subsided. About three weeks after the operation, the patient was again seized with severe pain in the part, which became again swollen, and extremely tender; but by leeches and medical treatment the symptoms were once more subdued, and he continued going on well for another fortnight, when matter began again to collect at the upper and back part of the scrotum; it was evacuated by a free opening; but as the walls of the abscess continued very hard, and discharged a thick purulent fluid, he was placed under salivation: from that time he gradually improved, and in three weeks was presented cured.

M. Ricord modifies the application of the seton by passing two, and employing them at the same time as sutures, in the following manner:—He first passes a long needle, armed with a double silk, horizontally through the tunica vaginalis, at the point of junction of the upper with the middle third of the tumour; and a second needle, armed in the same manner, at the junction of the middle with the lower third of the scrotum: he then draws off the fluid with a trocar, between the ligatures; and having emptied the sac, passes a piece of bougie or quill vertically through the loops of the double ligature on one side, and ties their free ends over a similarly placed piece of bougie on the opposite side of the scrotum, drawing the ligature tight; thus bringing a large surface of the tunica vaginalis of each side of the sac in close contact. From the violent effects produced by the common seton, I should certainly much fear the result of this more complicated mode of proceeding; but I have heard a surgeon who has seen M. Ricord apply it, say that it answers remarkably well, and that he never witnessed any bad symptoms arising from its use.

Among other methods of treating hydrocele—rather, however, with the view to its palliation, than to its permanent cure—is, that of puncturing the hydrocele with a fine needle, technically termed acupuncturation; a plan of treatment which was first recommended by my friend, Dr. Lewis, of Finsbury-place. The puncture must be sufficiently deep to enter the tunica vaginalis, and permit of the fluid exuding when the needle is withdrawn. In about three days after the operation, the hydrocele will have entirely disappeared, even when the accumulation of fluid is large. It is said, that when the hydrocele is small, the progress and manner of the cure is not perceptible; but when the hydrocele contains a large quantity of fluid, it is effused from the tunica vaginalis into the cellular tissue, and in the course of three or four days from the time of making the puncture, will be completely absorbed. The advantages stated to be obtained from this plan over the method of tapping by a trocar, which I shall next describe, are,—firstly, there is no danger of wounding the testicle; secondly, the reaccumulation of water takes place very slowly after puncture with a needle, even if the hydrocele be not permanently cured. Thirdly, the simplicity of the operation is so great, that it is not necessary to wait for a great accumulation of fluid before making the puncture. I believe this treatment has been tried in a large number of cases, and that it has proved very successful—that is, as successful as merely palliative treatment can be considered.

LECTURE LII.

CONTINUATION OF DISEASES OF THE GENITAL ORGANS—HYDROCELE.

Operation of tapping—Cases—Injection of a hydrocele by the old method—By tincture of iodine—Preparation of the patient—Cases—Mode of operation—Precautions in inserting the canula—Case—Manner in which the cure is effected—The hydrocele may be divided into more than one sac—Operation under such circumstances—Case—Care necessary to avoid throwing the injection into the cellular tissue—Cases.

Congenital hydrocele—Difference between it and simple hydrocele—Diagnosis—Case—Treatment—Encysted hydrocele—Cases—Spermatozoa in the fluid of the cysts—Hydrocele of spermatic chord—Diagnosis sometimes difficult—Condition of the swelling—Cases—Treatment—Encysted hydrocele of the spermatic chord—Treatment—Hæmatocele—Its characteristics—Symptoms—Cause—Treatment—Cases.

Operation of tapping.—This can only be considered as a palliative means of treatment, for the fluid usually reaccumulates if it be merely drawn off without any stimulating application being made to induce an altered action in the secreting membrane. It does, however, sometimes happen that a permanent cure is established by tapping; in simple cases of hydrocele, therefore, I always first try the effect of this safe operation before I have recourse to a more violent one. The instruments required are a trocar and canula, and the mode of using them is as follows:—The patient being placed before the operator in the standing posture, with his back resting against the wall, the scrotum is grasped with the left hand (the position of the testicle being previously ascertained); the fluid is then pressed forwards to render the tumour perfectly tense, and the trocar and canula, oiled beforehand, are quickly, and with a half-turn of the hand, giving as it were a semi-rotatory thrust, plunged into the tumour, usually in the lower third of the swelling: the forefinger of the right hand should be kept upon the shaft of the instrument during the time of making the thrust, so as to exactly regulate the depth to which it may be allowed to penetrate. The trocar and canula having entered the tumour, the trocar is to be withdrawn, and the canula being pushed *completely* home, the water is allowed to flow off. The degree of obliquity at which the trocar is inserted depends entirely upon the position of the testicle; it is, therefore, a matter of considerable importance to ascertain beforehand the exact situation of that organ, especially if the patient had ever before been subjected to this operation, as the first puncture may have produced adhesion of the testicle to the cicatrix of the old wound in the tunica vaginalis. If a surgeon were to take it for granted that in his second operation he would be safe in puncturing at the same point as before, he would incur the risk of wounding the testicle instead of penetrating the sac. In illustration of this Sir Astley Cooper relates the following case:—Sir W. ——, Bart., consulted an eminent surgeon with hydrocele. The latter attempted to draw off the water, but on withdrawing the trocar, which had entered the tumour with great difficulty, no fluid followed; violent orchitis supervened, and it was quite clear that the trocar had entered the body of the testicle. As soon as the inflammation of the testicle had subsided, the patient consulted Sir Astley Cooper for his hydrocele: he punctured the scrotum from behind, drew off the fluid, and the patient was immediately relieved.

Mr. Musgrove, of Finsbury Crescent, brought me a patient who was the subject of hydrocele, which, upon examination with a candle, I found to be unusual as to the situation of the fluid, the testicle being placed in front, although the patient had never before had an operation performed. I passed in the trocar at the posterior part of the scrotum, and readily drew off the fluid.

Simple, however, as is the operation of tapping, it should not be had recourse to without some preparation of the patient; for it has not unfrequently happened that without this precaution violent constitutional disturbance has been produced.

I was consulted by a gentleman, aged 68, who was the subject of a large hydrocele: the tumour was transparent, in no degree painful, and the patient appeared to be in good health: twelve hours after I had performed the operation of simple tapping, he was, however, seized with shivering, and great pain in the scrotum; inflammation continued to increase, sloughing ensued, his pulse became low and quick, his tongue covered by a brown fur, and slight delirium supervened; I ordered him calomel, large doses of Dover's powder, ammonia and serpentary; I also made incisions into the scrotum, applied a poultice of stale beer grounds, and allowed the free use of brandy and water: the patient ultimately recovered, although his life had been in great danger. After his recovery he told me that he was subject to hæmorrhoids, from which he was suffering greatly at the time he consulted me for the hydrocele: had I been aware of this, before the operation, I should certainly have deferred it.

Sir Astley Cooper mentions the following case which came under his notice, and to which I find affixed in his note-book "important:"—Mr. Green, of Lewisham, in October, 1798, drew off a quart of fluid from a hydrocele for Mr. Thompson, aged 64; nothing untoward occurred at the time, but sloughing supervened, and on the sixth day the patient died. Upon post-mortem examination nothing could be found to account for this termination as far as related to the hydrocele, but the liver was much diseased: Sir Astley remarks, therefore, upon the necessity of due examination of the general constitutional condition of a patient before submitting him to the operation for hydrocele.

I have already spoken of the necessity of a strict inquiry into the history of all cases of hydrocele; for although an abnormal secretion of serum may exist in the tunica vaginalis, it may be concomitant with disease of the testicle, which may render the operation of tapping either useless or injurious. Sir Astley Cooper mentions the following very interesting case:—A gentleman consulted him with a swelling of the scrotum, and stated that he had been to a surgeon, who had passed a trocar into the tumour, but that no water followed. Sir Astley discovered that his patient had some suspicious eruptions about his person, and he admitted that he had had syphilis six months before. Sir Astley placed him under a course of mercury, and in a short time the swelling of the testicle, and the fluid within the tunica vaginalis, were both removed. A patient once consulted me with a pyramidal tumour of the scrotum, which had formed insidiously, and without pain, and which, although opaque, from its distinct fluctuation I considered to be hydrocele, and passed a trocar into it: not more than a drachm of limpid fluid escaped, and having found my mistake, I at once applied a piece of plaster over the puncture: no ill effects resulted, and I subsequently removed the testicle, which proved to be affected by the sero-cystiform disease. I showed the patient to Sir Astley Cooper, who remarked, that from the size of the cyst, and fluctuating feel of the tumour, he was not surprised at my having mistaken the disease.

I have already said that tapping is not to be considered as a means for the radical cure of hydrocele, and I shall therefore now speak of the modes which are employed for the more certain cure of the disease, upon the reaccumulation of the fluid after the tapping has been performed.

Operation of injection.—For this mode of treating hydrocele, medical science is indebted to Sir James Erle; it has superseded all the other modes of which I have already spoken for effecting a radical cure. Wine and water, solutions of sulph. zinc, and various other agents fitted to induce inflammation of the tunica vaginalis, have been employed; but of late years, Mr. Martin, formerly of Calcutta, first recommended the following injection:—Tinct. Iodinii Co. ʒij.; Aqua destil. ʒvj. M. Of this mixture two drachms are thrown into the tunic after the serum has been withdrawn, and left there to produce its effects. Dr. Goodear, also of Calcutta, states, that out of two hundred and seventy-six cases in which he had employed this injection, he only failed twice in permanently curing the disease.

The mode of performing the operation of injection only differs from the simple tapping, in the operator being prepared with a syringe or an india rubber bottle, furnished with a stop-cock and nozzle; the point of the latter is to be inserted into the canula, and the fluid (whatever the injection may be) thrown into the tunica vaginalis. I ought, perhaps, to mention that the patient should be placed in the recumbent posture during this operation, for the acuteness of the pain may induce fainting. When port wine is employed as the injection, it is generally mixed with twice its bulk of water, or should this be a repetition of a former operation, equal parts of wine and water may be used. When sulphate of zinc is preferred, the solution should be of the strength of a drachm of the salt to a pint of water; and when either wine and water or solution of sulphate of zinc are injected, a sufficient quantity should be thrown in to distend the tunica vaginalis to about two-thirds of the size to which it had been extended by the serum. The injecting fluid is to be retained within the tunic until the patient complains of pain passing along the cord and extending to the loins, when it is to be allowed to pass off through the canula. It generally requires for the fluid to remain in the tunic about five minutes before the patient complains of the degree of pain considered to indicate the action necessary for the cure of the disease. After the injection has been withdrawn, the treatment of the patient must be regulated by the degree of pain he experiences; if this be very great, he should be kept in the recumbent posture, and upon low diet; but if it be moderate, so that it may not be considered to indicate quite sufficient irritation in the parts, he should take gentle exercise and generous diet to excite the requisite amount of inflammatory action. A successful result of the treatment is indicated by swelling of the scrotum, which gradually enlarges until it attains a size equal to that of the original disease; at this period the patient is generally much disappointed to find the inconvenience even greater than before the operation, not being aware that these symptoms are evidences of the effectual action of the remedies. In about four days the swelling begins to subside, the pain ceases, and although it may be some time before the part is restored to its natural state, the patient is perfectly convalescent. This operation is not, however, to be considered infallible, for I have myself known several instances of the disease returning after the employment of the injections of zinc and water, although they apparently produced all the effects necessary to the cure. Neither is it an operation that can be considered wholly free from danger, as the following case will prove:—William Rownslow, aged 60, was tapped by Mr. Morgan, and about twelve ounces of serum evacuated; port wine and water were injected, and the patient insisted upon going home: the same night he was attacked by acute inflammation of the tunica vaginalis: he sent for a surgeon, who mistook it for a case of strangulated hernia, and sent him back to Guy's Hospital: the tunica vaginalis was laid open, and the proper remedies prescribed, but sloughing took place, a high degree of irritative fever ensued, and on the third day the patient died.

Sir Astley Cooper, in 1824, operated on the Spanish Ambassador for the radical cure of hydrocele, employing wine and water as the injection; in thirty hours after, the patient was seized with trismus; large doses of calomel and opium were administered under the advice of Dr. Baillie and Mr. Cline, and the patient ultimately recovered.

Dr. Farre has told me, that in Barbadoes it is not at all uncommon for tetanus to follow injection of a hydrocele, and so much is this result dreaded, that surgeons in that country rarely attempt the radical cure, but merely have recourse to the palliative remedy of tapping. In Sir Astley Cooper's note-book I find the following remarks from information obtained from the same authority. "Dr. Farre related to me a case which fell under his notice in Barbadoes, of peritoneal inflammation following injection of a hydrocele, and which destroyed the life of the patient." It has always occurred to me that this might have been a case of congenital hydrocele, in which, of course, the injection ought not to have been employed.

In July, 1830, I injected a hydrocele with the solution of zinc, for a gentleman at the Trafalgar Hotel, and all seemed to progress quite favourably, for the first two days, when he was seized with a violent rigor, sickness, and great pain in the scrotum. Calomel and opium were ordered, and an effervescing draught, with an excess of ammonia. An opening was made into the tunica vaginalis, pus evacuated, and the patient recovered, although the irritative fever at one time had risen to a dangerous height.

From the evidence of these effects resulting from the injection of wine and water or zinc, and from the account given by Dr. Goodear of the almost invariable success which has attended the employment of iodine, I have for several years adopted the plan of treatment proposed by that gentleman, and out of thirty-seven cases have had but one failure, which can indeed scarcely be considered in that light, as a large portion of the injecting fluid accidentally escaped on withdrawing the canula. In injecting this fluid I never use the india-rubber bottle, but have a small brass syringe for the purpose.

One circumstance has struck me as very singular in the use of this injection; it is, that it frequently produces so little pain that I have, in some cases, considered failure as almost certain, and yet without either swelling or pain the cure has been complete. I subjoin one or two cases in illustration of this fact:—The Rev. Mr. H., of Norfolk, had had hydrocele on both sides for six years; two years ago he had the fluid drawn off from both hydroceles, and had the right side injected with wine and water, but ineffectually: a year and a half after, he had the same side injected with solution of zinc, and was cured. The left hydrocele then became troublesome, and he submitted to the injection of wine and water, which proved unsuccessful. He then had recourse to a second operation on the left side, when the surgeon employed zinc, which had previously succeeded, but on this trial it also failed. He consulted me in February, 1839, when I injected the tincture iodine in the proportions already described, and the disease was perfectly cured with little apparent inflammation or pain.

In July, 1840, I injected a hydrocele for a patient of Mr. McCann, of Parliament-street, with the iodine injection, in this case also with complete success, although the patient suffered no pain either upon the injection of the fluid or subsequently. An Irish peer came to my house and requested me to draw off the water from his hydrocele. I proposed to attempt the radical cure, to which he replied, "your uncle and three other surgeons have already injected the hydrocele ineffectually, and therefore I do not wish to submit to any further attempt." I stated to him the effect of the new injection, and then with his consent threw in half a drachm of compound tincture of iodine with a drachm and a half of water. The injection produced no pain. His lordship called upon me a week after, and laughed at my remedy, but from that moment, although the circumstance occurred four years ago, he has had no return of the disease.

The mode in which the cure is effected in all cases of injection, is, I believe, by altering the action of the capillaries of the tunica vaginalis, and not by the effusion of plastic matter, producing the adhesion of the sides of the tunic; in many preparations of the tunica vaginalis, after successful injection for hydrocele, no such adhesions are found. It sometimes happens that partial adhesions are formed, dividing the tunic into two or more sacs, and in such cases it has occurred that these sacs have secreted fluid, and the hydrocele has put on a complex form, being divided in distinct chambers, as it were, each of which must be opened for the evacuation of its fluid. In tapping a patient for hydrocele, at Guy's Hospital, I found the tumour only partly diminished after the fluid had escaped, and that a transparent fluctuating swelling still remained; this I then pressed against the canula, which I had kept in the first sac, and re-introducing the trocar, punctured it, and let out the fluid. I did not inject this case, in consequence of the peculiarity just named, and as I never saw the patient after, cannot tell whether the disease returned.

The only precaution necessary in the performance of the operation of injection, is to push the canula quite home into the cavity of the tunica vaginalis, for if it be only partly inserted, and not beyond the slit at the extremity of the canula, when you inject the fluid you will throw it into the cellular membrane of the scrotum, and not into the tunica vaginalis,—an accident which will probably produce sloughing of the whole scrotum. I have known this accident to occur several times with young operators, who are liable rather to push the trocar gently into the scrotum, than to jerk it in with the quick semi-rotatory motion necessary to its perfect introduction. When the instrument is gently pushed onwards the shoulder of the canula is very likely to carry the tunica vaginalis before it, without entering the cavity, so that the injection is only thrown into the subcutaneous cellular tissues, the probable result of which occurrence is shown in the following case described in Sir Astley Cooper's notes. "I injected a hydrocele for a man between fifty and sixty years of age, and the disease returned: about two years after, this patient was readmitted into Guy's under the care of Mr. Forster, who gave permission to one of his dressers to inject it; the canula was not properly introduced into the tunica vaginalis, so that the fluid was thrown into the cellular membrane of the scrotum: violent inflammation and mortification followed, and the patient died." I have known this accident to occur on three occasions.

As soon as you find, upon turning the stop-cock, that the injected fluid does not return through the canula, you may be certain either that the injection has been thrown into the cellular membrane, or that the canula has slipped out of the tunica vaginalis; some means must therefore be adopted for the evacuation of the fluid, and this can only be effected by incision. Lay open the tunica vaginalis in the case of the canula having accidentally slipped out, and make several incisions into the scrotum if the fluid be thrown into the cellular membrane; in either case, if these plans be adopted, dangerous effects may generally be prevented.

I may give you another useful hint, gentlemen, never to even tap a hydrocele, much less inject it, while there is any sign of inflammation, for even the puncture may be productive of harm.

A gentleman was the subject of hydrocele, and had frequently had the fluid drawn off: upon one occasion, in attempting to reach a book, he fell, and struck the scrotum against a chair; finding the part swollen and painful, he went to a surgeon, who immediately tapped him. Very little water passed, and what came was mixed with blood; violent inflammation followed, and it became necessary to lay open the tunica vaginalis by incision. This patient recovered, but not without having incurred considerable danger: the proper treatment here would have been to have allayed the inflammatory action before puncture was made into the tunic.

Congenital hydrocele.—The only difference between this and the simple hydrocele of the tunica vaginalis, consists in the circumstance of a communication existing between the tunic and the general cavity of the peritoneum. The physical signs of this kind of hydrocele are so similar to those of the simpler description, that its appearance alone by no means furnishes any diagnostic mark of the nature of the disease: but if from the youth of the patient, or any other cause, there be reason to suspect this congenital condition, you may test it by grasping the tumour firmly, when the fluid may be pressed into the cavity of the peritoneum, so that the scrotal tumour disappears, but returns soon after the pressure is removed. A young man, named Probert, some years ago consulted me for a hydrocele. Upon examination, I found the tumour perfectly transparent, and recommended him to have it immediately tapped; when, upon grasping the tumour firmly, to render it sufficiently tense for the easy introduction of the trocar, it vanished under my hand, and the nature of the case was at once rendered obvious. I desisted from the operation, ordered a truss to be worn, and afterwards succeeded in obliterating the connexion between the two cavities,—thus effecting a radical cure. Acupuncturation may be safely adopted in cases of congenital hydrocele that are not cured by the pressure of a truss. The mode of proceeding is to insinuate the needle into the tunica vaginalis by several punctures, which permit of the exudation of the fluid into the cellular membrane, where it becomes absorbed.

Encysted hydrocele is so termed when the fluid, instead of being contained within the tunica vaginalis, is secreted in an adventitious cyst; these cysts are well described by Mr. Curling as being analogous to the aqueous encysted tumours which are developed in the kidney and liver; I think he might have added, other organs covered by a serous membrane, for I have never found analogous cysts excepting under the splanchnic serous coverings. In the testicle they are usually found between the epididymis and its serous covering, but are sometimes placed between the tunica vaginalis and the tunica albuginea of the body of the testicle: in either case, upon examination, the tumours give the idea that they are completely adventitious, and that they are superadded to the natural structures of the part, while common hydrocele seems to implicate all the natural structures, and consists, indeed, merely in an inordinate accumulation of a natural secretion.

On the 4th of January, 1845, Mr. Tilsit, of Blackfriars Road, brought me a patient who had a small tumour in the scrotum, which, upon examination, felt like a supernumerary testicle; and, what is singular, when pressed, it gave the same sensation to the patient. Upon examination, the tumour, in this case, was found to be quite transparent, which proved it to be one of these aqueous encysted tumours. I punctured the tumour with a needle, ordered a lotion of hydrochlorate of ammonia and spirit of wine and water, and a suspensory bandage; the patient perfectly recovered.

December 1, 1837; a gentleman, aged 54, residing near Bristol, consulted me for disease of the left testicle, but stated, at the same time, that he had suffered very little pain or inconvenience. Upon examination, I found a small swelling, about the size of a walnut, situated at the upper part of the left testicle, immediately over the head of the epididymis, occupying the space between it and the spermatic chord. The tumour was fluctuating, and I at first thought it originated in a varicose state of the veins; but, as I could not empty the swelling by pressure, I examined it, and found it quite transparent. I punctured it with a needle, squeezed out the fluid into the surrounding cellular membrane, ordered evaporating lotions and purgatives, and directed the patient to wear suspensory bandages lined with oil-silk. This gentleman wrote to me two months afterwards, stating that he had perfectly recovered.

A patient was admitted under my care, at Guy's Hospital, who had a swelling upon the body of the testicle. The tumour was transparent: I punctured it with a lancet, and collected the evacuated fluid, which I found, upon examination, was very slightly coagulable by heat; in fact, it had all the appearance of spring water; but under the microscope—to which test I was induced to submit it, from having read a paper on the subject by the late Mr. Liston, —I found it contained spermatozoa, which proved the disease to be encysted hydrocele. The fluid re-collected before the patient left the hospital: I passed a seton of a single silk through the sac, and the disease was perfectly cured.

Professor Owen, upon being told that spermatozoa had been found in the fluid of these cysts, and being anxious to investigate the matter, as he had no opportunity of obtaining a recent case, examined the fluid of a preparation which had been put up some years before in the College of Surgeons, and, by the aid of the microscope, discovered a considerable quantity of dead animalculæ. Since Mr. Liston made this discovery, some surgeons have said that they have found these entozoa in the fluid of common hydrocele. I have frequently sought for, and found them in some instances, in this fluid; but Mr. John Dalrymple, who has written upon the subject, remarks, that he believes, when they are found under these circumstances, the surgeon had probably punctured either the vas deferens or testicle in evacuating the hydrocele.

Hydrocele of the spermatic chord is rather an unusual affection, and must result from a congenital tendency to its formation, in consequence of the tunica vaginalis of the spermatic chord remaining open, either between the two abdominal rings, or between the external abdominal ring and the testicle, leaving a space for the collection of serum. The disease is precisely similar to hydrocele of the testicle in every pathological point of view, but the diagnosis is much more difficult.

When the collection of fluid takes place in the inguinal canal, the resulting swelling has the appearance of a bubonocele, and it is often very difficult to distinguish the one from the other; for, although it has been said that in hernia the impulse in coughing will form a sufficient distinguishing mark, yet hydrocele also receives such an impulse from the influence of the abdominal muscles in the act of coughing, that we can scarcely rely on that indication. Its fluctuating feel, the absence of any derangement in the function of the bowels, and of all symptoms consequent upon such derangement, must form the principal guide; and if the tumour be prominent enough for its transparency to be discovered, the mystery is in a very great measure solved. I remember a friend consulting Sir

Astley Cooper upon the subject of a swelling in the left inguinal canal. He had shown it to Mr. Abernethy and other surgeons, who had pronounced it to be an irreducible hernia. Sir Astley, after very close examination, said he was certain it was only a hydrocele, which he laid open, let out the fluid, and the disease was cured.

In Mr. Tyrrell's edition of Sir Astley Cooper's Surgical Lectures, the following case is published:—

"Master ——, of Bedford, had a hydrocele of the chord, of six years' duration: it appeared mostly above, but partly below, the external abdominal ring; the tumour was very transparent. Mr. Pulling tapped the swelling, but the disease returned: he afterwards twice injected it with wine and water, but ineffectually. Sir Astley cured it by making an incision into the tunica vaginalis, and introducing flour; but two abscesses formed during the progress of its cure."

Mr. Curling seems to have adopted Mr. Potts' opinion, that this disease is an œdematous condition of the cellular membrane of the chord—an anasarcous effusion; but, from two or three cases which I have seen, I am inclined to believe that the collection of fluid is within the serous membrane itself; although there can be no doubt that an anasarcous condition of the chord occurs, as in other parts of the body, and may be cured by the same local and constitutional means employed for anasarca generally.

I remember, some years ago, seeing the beadle of St. Martin's parish, with Mr. Streeter, then of Drury-lane; this person was the subject of a swelling of the scrotum and spermatic chord, which were both so fluctuating that I punctured the scrotum with a trocar: only a few drops of fluid followed, and the œdematous condition was at once proved. Several small punctures were made, and by the assistance of constitutional remedies, the patient was relieved for the time; but, I believe, subsequently died, under the care of Mr. Streeter, of diseased kidnies.

I consider the best treatment for true hydrocele of the chord, whether seated in the inguinal canal, or below the external ring, is to open the tunic, evacuate the fluid, and apply a truss. I should hesitate before I employed an injection, from the dread of the ill effects which might result from the close proximity of the peritoneum; but this mode of practice is sometimes recommended.

Encysted hydrocele of the spermatic chord.—I consider this as similar in every respect to encysted hydrocele of the testicle, excepting in situation. The fluid is always in both cases exterior to the cavity of the tunica vaginalis, and is limpid and uncoagulable: whether or not the fluid of the encysted hydrocele of the chord contains spermatozoa, I believe has not been ascertained. The separate sacs which are sometimes found in the tunica vaginalis of the chord, are not, in my opinion, encysted hydroceles, but true hydrocele of the chord in the complex form, such as has already been described as sometimes occurring in hydrocele of the testicle.

The means to be adopted for the obliteration of these cysts, if they do not spontaneously disappear, are either acupuncturation or seton; the former should always be tried before having recourse to the more dangerous mode of the introduction of a silk into the cyst.

Hæmatocele is a collection of blood instead of serum in the tunica vaginalis; and the diagnostic marks between hæmatocele and hydrocele are, that, in hæmatocele, the effusion of blood results at once from the lesion of a bloodvessel, and therefore rapidly forms upon the application of the exciting cause; while the fluid of a hydrocele results from an inflammatory action, and only gradually accumulates. In hæmatocele the tumour is always opaque, and much heavier than in hydrocele; consequently greater inconvenience is experienced. If called to a recent case of hæmatocele, you will generally find the scrotum more or less ecchymosed, and distended by a fluctuating tumour; and, probably, the history of the case will show that a blow, or some other external force, has been the cause of these appearances, and is sufficient to constitute the diagnosis of the malady.

If hæmatocele be coexistent with a deteriorated state of the constitution, there may be some difficulty in forming the diagnosis, and the disease may be taken for chronic enlargement, or fungoid disease of the testicle. The most characteristic diagnostic mark is, the peculiar physical state of the surface of the tumour. In disease of the testicle, there is invariably more or less irregularity in the surface of the swelling; while in hæmatocele, it is smooth, and feels like a bag tightly distended by fluid; it does not, however, always give the most distinctive evidence of the presence of fluid—fluctuation; and there may consequently be insuperable difficulty in determining the nature of the disease by mere external examination. The diagnosis may always be rendered quite clear, however, by laying open the tunica vaginalis; if it be a hæmatocele, the operation will at once prove the fact, and cure the disorder, as it will be the means of evacuating the blood; while if it be disease of the testicle, it will be rendered equally manifest, and the diseased organ may be removed at once: indeed, in every operation for castration, this preliminary, or exploratory examination, may be most judiciously had recourse to.

Hæmatocele not unfrequently results from the operation of tapping a hydrocele, in consequence of the trocar wounding some distended vessel of the skin, or tunica vaginalis. In such a case, a few hours after the serum has been drawn off, the swelling is as large as ever, from the accumulation of blood. The largest hæmatocele I ever saw was produced in this manner.

A gentleman who had long been the subject of hydrocele, and who was unwilling to submit to the radical cure, was in the habit of having the operation of tapping performed as occasion required. Not liking, however, the expense this involved, he contrived an apparatus for the purpose of operating on himself, and which was so constructed as to preclude the necessity for forcing the trocar into the tumour by the hand; and for this purpose he removed the barrel from a pistol, and, after sawing off the stock in front of the cock, attached a short canula and trocar to the hammer, so that, by pulling the trigger, the trocar was driven into the scrotum. His first operation was so successful that he quite prided himself on his ingenuity. His triumph was, however, short-lived; for, on a fresh accumulation of serum, in his very next attempt, directly after he had drawn off the water, he was surprised to find the tumour beginning to swell again; and in the course of two hours it was as large as ever. He applied cold applications, and remained in bed, hoping that what he considered as mere inflammation would soon subside. Finding, however, that this did not take place, in the course of a few days he sent for a surgeon, who told him that it was fungoid disease, and that the testicle must be removed. I was then called in consultation, and recommended that an incision should be made into the tunica vaginalis, when a large clot of blood, with some serum, was removed; and the patient recovered, not only from the hæmatocele, but also from the hydrocele which had formed the original disease.

The only treatment, indeed, in hæmatocele, is that mentioned in this instance, viz., the laying open the tunic, and turning out the clot. Cases are recorded, although I have never had an opportunity of seeing one, in which, after laying open the tunica vaginalis, and removing the coagulum, fresh hæmorrhage has immediately occurred, rendering it necessary to apply a ligature to the bleeding vessel. Indeed, it has been stated, that when this tendency to hæmorrhage has existed, and no bleeding vessels could be discovered, it has been necessary to extirpate the testicle.

I admitted a patient, about a month ago, into Cornelius ward, Guy's Hospital, who, a fortnight previously, had received a blow on the scrotum. Upon his admission, the scrotum was on one side three times its natural size; and, in form, presented the appearance of a hydrocele, but was perfectly opaque. Upon manipulation, the tumour partly fluctuated, but a large solid mass was discoverable. As the patient mentioned that the tumour was formed immediately after the blow, I considered it to be hæmatocele, and proceeded to lay open the tunic. A quantity of serum escaped; and, by introducing the fingers, I turned out a mass of nearly colourless fibrin, the colouring matter of the blood having been absorbed. These are good examples of the cases of hæmatocele which have occurred in my practice.

I have met with an accumulation of fluid in the tunica vaginalis, which could scarcely be described either as hydrocele or hæmatocele, from the character of the sanious fluid which was contained in the sac, and which I believed to depend upon the hæmorrhagic diathesis of the patient, and not upon the nature of the accident. I saw a gentleman, who, in riding in the Park, had received a blow on the scrotum: it produced but little pain at the time, although considerable swelling immediately took place. He consulted me four days after the accident. I examined the state of the scrotum, which presented most of the signs of a hydrocele, being fluctuating, but quite opaque; and as the swelling had occurred so rapidly after external injury, I had no doubt of the disease being hæmatocele, and proposed therefore to immediately lay open the tunic; upon doing this, I evacuated eight or ten ounces of sanious fluid, without any coagulum in it. The opening I made was small, and soon healed: but, in a fortnight after, the patient returned to me with a fresh accumulation of fluid, which I drew off by the common operation of tapping, and found it of the same sanious character as in the former operation. This led me to suspect that the disease depended upon constitutional deterioration; and, upon questioning my patient, I found that he displayed a hæmorrhagic tendency, as he informed me that the slightest blow always produced an ecchymosis on the injured part. I ordered him mineral acids and bark, animal food, sea air, &c.; and the disease never reappeared. In fact, the nature of the fluid found in hydrocele, or even hæmatocele, differs much, according to the constitution of the patient; being sometimes as highly coagulable as healthy serum, sometimes oily, from the presence of fat, and sometimes containing cholesterine, and, in other cases, being mixed with blood. In short, I may sum up by saying, that the capillaries of the tunica vaginalis are liable to various deteriorations, and that the effusions vary correspondingly with the conditions of the serous membrane.

LECTURE LIII.

CONTINUATION OF THE DISEASES OF THE GENITAL ORGANS.

Hæmatocele of the spermatic chord—Very rare—Case—Treatment—Diagnosis sometimes difficult from complications—Case.

Hydrocele in the female—Symptoms.

Chimney-sweepers' Cancer—Character of the disease—Generally confined to the scrotum—Progress of the disease—Seldom attacks any but chimney-sweepers—Diagnosis—Treatment—Cases.

Elephantiasis scroti—Almost peculiar to tropical countries—Characters of the disease—Identical with similar affection in the leg—Diagnosis—Medical treatment—Surgical operation.

Prurigo—Chiefly a disease of old people, but sometimes arises from the presence of ascarides—Treatment—Sloughing of the scrotum—From external injury or injections in hydrocele.

Hæmatocele of the spermatic chord implies effusion of blood into the tunica vaginalis of the chord; it is, however, of extremely rare occurrence, in consequence of the small space within the tunic, and its slight liability to external injury compared with the tunica vaginalis of the testicle. Mr. Pott has related some cases; I have myself never seen one, excepting under the form of diffused hæmatocele, when the extravasation of blood takes place either between the tunica vaginalis and the vessels of the chord, or between the tunica vaginalis and the fascia spermatica; but the distinctions between the two situations in the living subject, I should think, could not be diagnosed. A gentleman, in straining to pull on a new pair of boots, experienced a sudden pain in the spermatic chord; swelling rapidly followed, and he consulted me under the belief that he had ruptured himself. The fluctuating character of the swelling, the absence of any distention into the inguinal canal, and the ecchymosed appearance of the part, led me to suspect the real nature of the injury. I recommended him to remain in the recumbent posture for some days, applied a few leeches, and afterwards a stimulating lotion, and the fluid was soon completely absorbed. The physical conditions of hæmatocele, and those of hydrocele (especially if encysted), so closely resemble each other, and so assimilate at the same time to hernia, that it is sometimes impossible to distinguish these conditions from one another by their external qualities only, and a just conclusion can only be drawn by exploration. It may appear to you, gentlemen, that such a mode of procedure can hardly be required; but imagine a patient with one of these anomalous tumours, and concomitantly with it such an obstructed state of the bowels, that it becomes at once imperative to ascertain whether or not the obstruction depends upon physical constriction; if so, nothing but an operation will relieve the patient; while, on the contrary, if, by exploration, you discover that the tumour is unconnected with the disturbed function of the bowels, you are then justified in trusting to constitutional remedies. These considerations lead me to speak of the various complications to which hydrocele, hæmatocele, and hernia are liable. A patient may have hydrocele, either of the tunica vaginalis testis, or of the spermatic chord, and at the same time be the subject of hernia. He may have a hernia, under which circumstances a blow upon the scrotum may cause the complication of hæmatocele with the hernia. Or the three may be coexistent. In such cases of complication the diagnosis becomes excessively difficult, as the physical conditions of each more or less present themselves, and tend to produce great confusion and uncertainty. I have myself met with these difficulties: I was once performing an operation on a man in Guy's Hospital, who had a tumour in the right inguinal canal, which, from his symptoms, and the physical character of the tumour, I had no doubt was a bubonocele; in the course of the operation, on laying open the sac, a large quantity of fluid escaped, and an undescended testicle presented itself. The existence of these conditions was not, however, sufficient to account for the symptoms; but on passing my finger to the neck of the sac (the tunica vaginalis) I discovered a portion of constricted intestine: I divided the stricture, and returned the intestine into the abdomen; but the patient subsequently died of peritonitis. In fact, in speaking of the complications of hernia with hydrocele, hæmatocele, and with diseases of the testicle, so great a variety of indications may occur as to render it absolutely impossible to describe each separately: nor do I believe that any benefit could be derived from attempting it, as the only means by which we can arrive at a just estimation of the peculiarities of any case that may be presented to our view, must be scrutinous examination of every physical sign and constitutional symptom which may be present, so that we may be enabled to form a diagnosis: should these difficulties be insuperable, there is nothing left but carefully to explore the abnormal protrusion.

Hydrocele in the female.—As the round ligament of the uterus is furnished with a covering of tunica vaginalis, in the same manner as the spermatic chord in the male, there can be no doubt that this serous covering is liable to similar diseases in both sexes, although it is much less frequent in the female, in consequence of the small size of this structure. The symptoms arising from this disease in the female are precisely similar to those already described—they afford the same difficulties in diagnosis—require the same means for relief—and permit, therefore, of no further description than has already been given in reference to this morbid condition in the male subject. Œdema of the round ligament, sometimes called diffused hydrocele, may also occasionally occur, as in the male, when there is a general anasarcous tendency, or when any mechanical obstruction to the circulation interferes with the nutrition of the part; but as I have never myself seen any of these affections in the female, I merely speak of them as incidental to the tissues entering into the composition of the different structures, and not from my own experience.

CHIMNEY-SWEEPERS' OR SOOT CANCER.

I do not think the term cancer strictly appropriate to this disease; for although it is probably true that a patient who is the subject of this local affection must have a predisposition to its development, still, few cases are recorded in which it has arisen from any other exciting cause than that produced by the irritation of soot. It may, however, be fairly conjectured, that where a certain diathesis prevails, the continued irritative influence of such a substance as soot may produce a local malignant development. Still, a difficulty attends this view; for as the whole surface of the body is more or less subjected to the same source of irritation, it is difficult to understand why the scrotum more than any other part should so generally become the seat of the disease: to this the answer may be, that the rugous and delicate character of the skin, the size and number of the follicles with which it is furnished, and perhaps its pendulous position and its being usually in a moist state, may tend to render it more than any part of the body susceptible to diseased action from continued irritation. A very similar disease is prevalent in the West Indies, under the name of sun-wart: this attacks the face in old people, and usually makes its appearance in the wrinkles and furrows, which naturally harbour perspiration, and in which the follicles are larger and more numerous than in other parts. Chimney-sweepers' cancer is a rare disease, and is but seldom met with, even in the class to whom it may be almost considered peculiar; soot, therefore, must be looked upon, not as possessing any particular property of producing this carcinomatous affection, but as merely determining or exciting the action in individuals in whom there exists a malignant constitutional tendency. In support of this view, I may adduce the circumstance of soot cancer appearing in some cases to be hereditary; and, among many others, an instance is mentioned in which Mr. Earle removed the disease from a chimney-sweeper in St. Bartholomew's Hospital, whose grandfather, father, and brother, had all died from its effects. The disease commences under the form of a small tuberculated growth called "soot-wart." The development of this takes place but very slowly, and years sometimes elapse before any great change can be observed in it. After a time, however, other similar pimples are formed, and ultimately run together and constitute a large irregular warty excrescence, from which a thin fluid exudes, soon causing the morbid growth to be covered with a scab. Ulceration shortly sets in, removing the scab and producing an open sore, which possesses the characteristics of true carcinoma. Severe lancinating pain is experienced in the part, and extends upwards into the groin, and the disease sometimes involves the glands of the groin and the lumbar glands, but this is not an invariable feature of its progress; the ulceration proceeds, however, to the neighbouring structures, extending to the groin, abdomen, and downwards to the thigh. Violent darting pains and a pricking sensation attend all the steps of the complaint. Repeated hæmorrhages occur, from the giving way of small vessels; and in some instances it has been known that the ulceration has reached the large vessels of the thigh, in which case the profuse hæmorrhage has caused immediate death; but more generally the inevitably fatal termination ensues rather from the destruction of the constitutional powers of the patient under the prolonged suffering and irritation to which he is subjected. It is remarkable that the progress of cancer of the scrotum differs materially in one respect from ordinary cancerous affections, its effects being chiefly confined to the tissues and structures immediately around it, and it does not to the same extent possess the tendency to propagate itself to distant organs through the medium of the lymphatics; and although, as I have remarked above, it does sometimes involve the inguinal and lumbar glands, this is generally a very late symptom; and, therefore, early extirpation in this disease offers a much greater chance of ultimate benefit to the patient than in any other species of malignant development; indeed, where the disease has reappeared after the operation, it has generally not been in the cicatrix of the old incision, but in its neighbourhood, and ought perhaps rather to be regarded as a fresh attack of disease, than the renewal of an old one —the second, as the first, depending upon the peculiar diathetic tendency of the individual exposed to the exciting cause of the disorder.

The following cases will illustrate the usual progress of the disease. The first is given by Mr. Curling :—

William More, chimney-sweep, æt. 51, came under the care of Mr. Curling, in 1843, for a painful swelling in the groin. He had been affected with chimney-sweepers' cancer for many years. In 1821, a portion of his scrotum thus affected was excised at St. Bartholomew's Hospital, and he had afterwards undergone two other operations in that hospital, in consequence of a return of the disease. Another part of the scrotum was afterwards removed at Guy's Hospital, and a further portion of the integument was excised by a surgeon in the City, making altogether five operations. There was a tumour in the groin, which was soft in the centre, and fluctuated, but had a very indurated base, and the patient complained of pricking and shooting pains in it. This swelling in the groin, which was evidently of a carcinomatous character, had only existed for a few months, though the disease in the scrotum had commenced two-and-twenty years before.

John Hooper, a chimney-sweeper, æt. 34, came into Guy's Hospital in 1846 with cancer scroti. About eight months previously a wart appeared on the scrotum : this soon became painful at night, ulcerated, and gradually increased in size, until it was as large as a five-shilling piece. The ulcer was excavated in the centre, the edges being everted, rugged, and very hard: it discharged a thin, fœtid, sanious fluid, and the patient suffered acute lancinating pain. In August the disease was removed by excision. During the process of healing, the wound was forced open by the descent of an old hernia; but early in September he left the hospital cured.

James Steward, æt. 31, chimney-sweeper, admitted into Guy's Hospital with cancer of the scrotum. Three years before, he first observed two or three small pimples on the anterior part of the scrotum. These excited much itching, and in scratching them he rubbed off the skin, when they began to discharge a thin, watery, yellowish fluid, which was occasionally very fœtid. About nine months after the pimples first appeared, he applied hydrochloric acid to one of them, which began from that time to increase with great rapidity, the discharge becoming more profuse. There was, at the time of his admission, an excrescence the size of a half-crown, resembling hypertrophied granulations, the edges turned over and everted, and discharging a thin, puriform, offensive fluid. The excrescence was completely detached from the testicle, the scrotum alone being the seat of the disease. There were small spots on other parts of the scrotum covered with a dark-coloured incrustation, and severe darting pains were experienced in the parts. The disease was removed by operation, two or three small warts being extirpated singly. The wound soon healed by granulation, and in the course of a month after the operation he left the hospital cured.

Charles Evans, æt. 28, admitted into Guy's Hospital, 1840: a chimney-sweeper, of cachectic appearance, the subject of cancer scroti. Two years before he was in the hospital for the same disease, when one side of the scrotum and the testicle, which was also diseased, were removed by Mr. Morgan. After the operation, he returned to the exercise of his trade, and the disease had again made its appearance about two months before his second admission into the hospital. The scrotum was now much indurated, and about the centre there was a kind of sinus, from which a serous fluid exuded. The testicle was adherent; the patient suffered much from acute lancinating pain, extending up the inguinal canal, and from pain in the loins. An incision was made in the scrotum: this relieved the pain, and for some time puriform matter was discharged; it ultimately, however, became sanious, and the pain returned. This case was discharged without operation, as the spermatic chords (and probably the lumbar glands) were affected, and the operation was therefore deemed useless.

Thomas Morris, a chimney-sweeper, æt. 36, was admitted into the hospital, 1845, with cancer of the scrotum: he was of intemperate and dirty habits, washing only once a week. About sixteen years before, he was operated on in St. Thomas's Hospital for the same disease. Some time after this, several horny excrescences grew from the scrotum, just below the cicatrix of the old wound. One of these bodies was as large as a finger, curving downwards; the others were much smaller: they were removed about a year before his admission into the hospital, according to his description, by caustic. The wound never healed. On the right side of the scrotum was an ill-conditioned sore, extending from the raphé to the integument of the thigh: it consisted in great part of warty granulations, and towards the edges it was in a state of ulceration: the discharge was thin and fœtid. The patient left the hospital without allowing the disease to be removed.

John Sullivan, æt. 35, admitted into Guy's Hospital with chimney-sweepers' cancer. About nine months before, he had been under Mr. Morgan's care for the same disease, at which time the left testicle was removed by operation. He left the hospital before the wound was completely healed, and returned to his business; but not being particular in keeping the dirt and soot from the part, the disease soon began to increase. When admitted into the hospital, there was a large irregular sore, with hardened and ragged edges, occupying the whole of the left side of the scrotum, and exuding a thin, watery, fœtid matter. There was a fistulous opening through the lower and under part of the urethra, by which all the urine flowed: the orifice of the urethra was closed by dirt and filth. Shortly after his admission the right testicle became affected, the ulceration having extended through the septum; there was a most intolerable sensation of itching all over the surface of the sore. The spermatic chord was healthy, but there were two enlarged glands in the right groin. Palliative treatment was adopted, but no operation performed. He died from exhaustion about four months after he entered the hospital. On a post-mortem examination, it was found that the ulceration had extended downwards towards the perineum, laterally to the groin, laying open the urethra, and upwards to the pubes. The two enlarged glands in the groin presented a strumous appearance when cut into; the liver was easily broken down; the kidnies hypertrophied, and full of numerous suppurating points on their surface; the bladder was distended, and the urine it contained turbid, and mixed with shreds of albumen, mucus, and pus. There was no enlargement or apparent affection of the glands, with the exception of those already mentioned.

Edward Anderson, æt. 66, chimney-sweeper, taken into Guy's Hospital for cancer scroti: fifteen years before he had been operated on by Mr. Green at St. Thomas's, when an ulcer about as large as a shilling was excised from the scrotum. The wound soon healed, and he remained free from any return of the disease for twelve years, when a small pimple appeared on the right upper arm. At the time of his admission he had an ulcer on the under and front part of the arm, about as big as a half-crown, and with raised and hardened edges: this was very painful. He had also another ulcer, about the size of a sixpence, upon the under part of the prepuce: it had commenced as a wart about ten months before. Zinci chloridi with starch was applied to both ulcers, and that on the prepuce soon appeared to be completely cured; on the arm the ulcer had a healthy aspect. Opium ointment was applied to it: he refused to submit to an operation. Zinci chloridi was continued, and the sore apparently healed, so that he was discharged from the hospital.

Some of these cases are unsatisfactory, inasmuch as they give no history of the termination of the complaint, but they nevertheless serve to illustrate the progress of the disease, and the general effect of the treatment employed.

The diagnosis in this disease can seldom, I think, be attended with much difficulty. In the cases I have witnessed, the peculiar character of the tumour has been well marked, and the appearance and general features of the disease are so remarkable that it can scarcely be mistaken for any other; the history of the complaint, and the occupation of the patient, will also serve to facilitate the diagnosis. In investigating a case, it should not be forgotten that this disease sometimes makes its appearance many years after the individual has ceased to be exposed to the influence of soot; and there was lately a man in the University Hospital who was the subject of this disease, but who had given up the occupation of a chimney-sweeper twenty years previously. There is also mentioned by Mr. Curling, the case of a sailor, who had been apprenticed to a chimney-sweeper, but who had been a seaman for seventeen or eighteen years, when at the expiration of that time the affection became developed.

In this, as in all affections of a similarly malignant character, medical treatment can do nothing more than alleviate the sufferings of the patient.

Extirpation offers the only chance of permanent benefit, and this ought the more readily to be resorted to, as there is less chance of the return of this than other carcinomatous diseases, after operation. Alterative remedies, such as iodine, sarsaparilla, and opiates to relieve the pain and diminish the tendency to ulceration, when it has commenced, are also indicated; and as there is usually a peculiar fœtor emitted from the sore, I have found weak solutions of chloride of zinc useful in removing it, and in improving the condition of the ulcer itself.

The only effectual means of treatment, in my opinion, however, is to be found in the early removal of the wart, before it proceeds to ulceration; entirely removing, if possible, the patient from the influence of soot, so as to prevent the exciting action of that substance upon a constitution already shown to be susceptible to its baneful effects.

ELEPHANTIASIS SCROTI.

This disease appears to be almost entirely confined to the inhabitants of warm climates: it is frequent in different parts of Asia, Africa, and Egypt, and among the negroes in the West Indies, especially in Barbadoes. Some instances of this complaint have, however, occurred in Europeans, and there is, in the museum of the College of Surgeons, a tumour weighing 45lbs., removed by Mr. Liston, at Edinburgh, from a young man aged only 22. These tumours often attain an enormous size: they vary much in form, but are generally large towards their inferior extremity, being attached to the pubes by a narrow neck: in some parts of their surface they are hard and unyielding to the touch, while in others a sensation of fluctuation may be detected. There is no appearance of inflammation, but the skin becomes much thickened and distended, and is sometimes covered with a yellow scab and superficial ulcers. The spermatic chords and testicles usually remain unaffected, the latter retaining their former integrity, and, when the tumour is not of a great size, can be felt at its posterior part; but if it be very large, they become lost in the mass.

As the tumour increases, the penis becomes involved in it, and is enveloped and hidden in the surrounding integuments: the prepuce is obliterated, and the only trace of the penis is found on the anterior part of the tumour,—as a mere orifice from which the urine trickles, without forming a jet. The remote cause of these tumours is unknown; they often follow blows upon the scrotum, and are generally developed very slowly, acquiring gradually a bulk and weight which interfere with every motion of the patient, often proceeding to such an extent as to render life perfectly intolerable.

Elephantiasis of the scrotum appears to be identical in character with the morbid condition not uncommon in the legs, among negroes in the West Indies. A similar affection also attacks the labia pudendi in females in tropical countries, although the enlargement does not in that case occur to anything like the same extent as when the disease is seated in the scrotum. The true nature of this disease is not as yet by any means understood: by some surgeons it is attributed to inflammation of the lymphatics; by others to some affection of the venous system; these views are, however, neither of them satisfactory, nor sufficient to account for the peculiar features of the complaint. It is remarkable that it produces but little effect upon the general health of the patient, the constitutional powers remaining for many years uninjured, although the patient is exposed to the constant inconvenience of having an immensely enlarged scrotum, in some cases weighing more than 100lbs.

In the diagnosis of elephantiasis scroti there can be but little difficulty; the only affection for which it can be mistaken is œdema of the scrotum, and this is only in an early stage of the disease. I have myself never seen a case of this disease of the scrotum in a European, but have several times met with albuminous effusions in the lower extremity, in which it seems as if the fluid coagulated within the cellular membrane, instead of constituting common œdema; and although the enlargement of the limb in these cases has never approached in extent that in "Barbadoes leg," still the natural symmetry has been so completely lost, and the skin rendered so pachydermatous, that it was impossible not to detect the typical character of elephantiasis; and I think I have observed that the persons obnoxious to this disease have all been of a phlegmatic temperament; such, in fact, as are prone to anasarca, with this distinction only, that the effusion has become coagulated instead of remaining fluid.

The treatment which I have followed in these cases has been that recommended by Baron Larrey—viz., the administration of small doses of tartarized antimony, and at the same time the application of pressure to the part. I have, however, generally combined with the tartarized antimony small doses of colchicum and blue pill, and have found the treatment so invariably effectual, that I doubt whether, if cases of elephantiasis were early treated in this manner, they would not be found less irremediable than they prove when allowed to attain the immense growth of which they are susceptible, and which is sufficient to render their removal the only means of cure.

Many cases are recorded of the successful extirpation of these enormous tumours. The danger of the operation depends upon the loss of blood and upon the sudden division of the spermatic chords and penis, when the genital organs are removed with the tumour; and it is upon the latter danger that my mind so much dwells. I am of opinion the organs of generation should always, if possible, be saved; not that I should think of first dissecting them out, but as they are invariably surrounded by a mass of adventitious growth, I should be disposed to make a large anterior and posterior flap with a long and sharp-pointed knife, and, having secured the bleeding vessels, examine for the situation of the organs of generation, separate them from their deep connexion with the tumour, and then remove the whole of the morbid growth below, leaving the dissection of the disease still surrounding the genital organs for the second step in the operation: this would consist in adapting portions of the flaps left as coverings to the genital organs, removing the superfluous mass of integument. I witnessed the operation performed by Mr. Key, in the case of Hoo Loo, and certainly the impression on my mind was, that the immediate cause of death arose from the powerful constitutional impression produced by the simultaneous removal of all the external organs of generation, rather than from loss of blood: the plan which is to be adopted must always depend, however, upon the peculiar circumstances connected with each case.

Prurigo is another disease to which the skin of the scrotum is liable, especially in old people. It creates the most painful itching, and indeed may be considered more troublesome than dangerous, arising frequently from some intestinal irritation, and if attacking younger people, almost invariably depends upon ascarides, and therefore remedies should be first given to ascertain whether worms are present. If it cannot be proved that the disease is produced by the presence of worms, or if the removal of that source of irritation does not cure it, alterative remedies should be prescribed, and mercurial ointment, as a local application, is frequently recommended. I have, however, found the following lotion much more effectual than ointments of any description:—

℞ Potassi Sulphuret. ʒj.
Liq. Calcis, ℥viij. M.
Ft. lotio sæpe applicanda.

One certain benefit will be derived from the lotion—viz., the almost total cessation of the painful itching; and, excepting in very old people, I have rarely found the application prove ineffectual. I once saw a disease in the scrotum, in a man of peculiar gouty diathesis, which I believe to be extremely rare: it consisted in numerous tubercles, developed on the surface of the scrotum, and filled with chalky concretions, similar to those deposited in the joints of gouty people; and what was singular, the patient was much relieved in his general health, as soon as these depositions took place in the scrotum. Colchicum and purgative medicines were prescribed, but no surgical means were employed beyond turning out the most prominent masses of concrete matter, as the ulceration of the skin exposed them.

Sloughing of the cellular membrane of the scrotum is of frequent occurrence, owing to the great laxity of the tissue; it very frequently follows external injury and the inflammation produced by injections in hydrocele; but the only circumstance worthy of remark in these cases is, the facility with which the part subsequently heals after the sloughs have been thrown off.

LECTURE LIV.

DISEASES OF THE BREAST.

Frequency of diseases of the breast in the female—Probable cause—Classification of breast disease—Acute inflammation of the mamma—Results of inflammation in the breast—Abscess of the breast—Symptoms—Treatment—Soreness of the nipple—Symptoms—Case—Chronic inflammation of the breast—Diagnosis—Treatment—Cases—Irritable mamma—Symptoms—Treatment—Atrophy of the breast—Hydatid breast—True hydatid breast—Treatment—Sero-cystiform tumour of the breast—Characteristics of—Case—Ecchymosis of the breast—Rare disease—Treatment—Case.

The human female mamma is very frequently the seat of the most important diseases, and notwithstanding the statement of physiologists, that the organs of generation and of the senses are not essential to the existence of the individual, how great is the number of women that yearly fall victims to diseases developed primarily in these glands, although, perhaps, it may be said that a fatal termination does not arise from the primary action, but from its secondary effects upon the constitution.

The mammæ are naturally intended to perform a very important function, from which they are frequently withheld during the whole period of life; and although they sympathize at stated times with certain conditions of the ovaries, this action shortly subsides, and the breast returns to a quiescent condition, apparently without having performed any functional act or produced any compensating secretion to allay the periodical excitement. Such disappointment, if I may venture upon the expression, appears to me sufficient to account, in great measure, for the tendency to deterioration of which these organs are so susceptible, even in otherwise healthy women; while in those of cachectic diathesis, such an interference with the intentions of nature produces that lengthened category of abnormal conditions of the breast known under the term "breast diseases."

Sir Astley Cooper has divided the diseases of the mammæ into three classes:—

1stly, Those arising from common inflammation, either acute or chronic.

2ndly, Those arising from a peculiar action, but which are not malignant, and do not contaminate other structures.

3rdly, Those which are founded on a malignant and specific action, and which are connected with a peculiar and general unhealthy state of the constitution.

Acute inflammation of the breast.—Increased action in the breast is of rare occurrence, and this may, indeed, be said of all the secreting glands, unless there be interference with their natural secretions, or some powerful external exciting cause of the inflammation.

When acute inflammation occurs, it is attended by all the phenomena that mark increase of action in other structures—viz., swelling, pain, heat, and redness; also great intolerance of pressure. Such signs of inflammation would point to the employment of antiphlogistic remedies: and the timely application of leeches, purgative medicines, and fomentations, or evaporating lotions, to the part affected, will often lead to the termination of the attack by resolution; unless suppressed lactation, retention of the milk, or some other exciting cause, keeps up the inflammatory action. The immediate result of this inflammation depends very much upon the tissue affected, and the constitutional condition of the patient: it may attack either the skin, cellular membrane, fibrous envelope, or secreting structure of the gland itself; the inflammation producing a train of symptoms, the character of which depends upon the tissue which is attacked, but being at the same time modified in a great degree by the general health of the patient. When the inflammation is seated in the skin, redness constitutes from the first the chief local sign of disease, and the pain is of a peculiar tingling character; in certain constitutions this cutaneous inflammation may have a tendency to take an erysipelatous form, so that in such cases the general health of the patient is a point of much importance.

If the cellular membrane be inflamed, effusions of differing character are thrown out, according to the period of inflammation and the constitution of the patient: swelling is, therefore, a symptom, and the hardness will depend upon the degree of solidity or fluidity of the effused matter; the swelling may consequently be œdematous, fluctuating, or solid, the treatment being in a great measure indicated by the physical state of the part.

Œdema is a species of dropsy, being produced by an accumulation of serum in the cellular membrane. The kidnies, skin, and bowels, should, under these circumstances, be excited to increased action, and where the constitution seems to be at fault, the acetate or nitrate of potash, with sudorifics and small doses of mercury, should be exhibited; but if the œdema seems to depend wholly on local causes, topical remedies will be found sufficient.

Abscess of the breast.—When distinct, circumscribed fluctuation is present, preceded by rigors, it indicates the existence of pus, and, generally speaking, this should be at once evacuated by an incision; if the formation of pus depends, however, upon retention of milk, constituting what is called a "milk abscess," and if at the same time the matter be deeply seated in the substance of the gland, it is better not to open the abscess unless very severe constitutional irritation be manifested, but to wait nature's own time and means for the evacuation of the pus. Tonics and sedatives, with soothing fomentations, should be employed in these cases, and much benefit will be derived from drawing off the milk with an apparatus made for the purpose; this seems to afford more relief than the sucking of the child at an inflamed breast: perhaps the mechanical means is less exciting to the organ, as putting the child to the breast always produces "a draught" of milk.

When the fibrous envelope of the breast becomes inflamed, it is generally after abscess in the cellular membrane: it is attended by sloughing of the fibro-elastic tissue, and the consequent formation of sinuses, which generally require to be laid open, for the purpose of removing the sloughs before they will heal. Black-wash poultice is the best local application in these cases, but tonic medicines and generous diet must also be freely employed.

When the mammary gland itself is attacked by inflammation resulting from distention of the lacteal tubes, abscess is the frequent termination; suppuration may, however, take place in consequence of the inflammation of the fibro-elastic tissue, which not only constitutes an envelope to the whole breast, but is prolonged between the lobes of the glandular structure, so as to surround every lobule. The matter in this case becomes interstitially diffused, and artificial openings generally afford but little relief. When suppuration is caused by distention of the milk tubes, the abscess is more circumscribed, and the evacuation of the pus gives immediate relief: the necessity for puncture is sometimes obviated by the pus flowing through the nipple.

After inflammation of the mammary gland, a degree of hardness is sometimes left which may be mistaken for carcinoma or some other malignant disease: the history of the case will generally lead, however, to a correct diagnosis, and when the hardness depends only upon the effusion of an inflammatory product, poultices, mild mercurial ointments, or pressure, may be required to produce absorption.

Fissures or abrasions of the nipple are not unfrequent causes of the extension of inflammation to the glandular tissue of the breast; if there be likewise any abnormal condition or deformity of the nipple during the period of lactation, retention of the milk and consequent inflammation of the mammary gland are produced, often terminating in abscess. Imperfect development of the nipple may lead to the same result; but this can sometimes be remedied by using a mechanical apparatus to lengthen the excretory portion of the organ: as soon as this is effected the child should be restored to the breast, as the natural stimulus produced by its sucking is likely to elongate the nipple and thus to render it better adapted to its purpose.

Sir Astley Cooper describes a swelling which is sometimes produced in the breast from retention of the milk, but which, instead of producing an abscess, forms merely a fluctuating tumour, generally attended by pain: if this tumour be opened, a quantity of milk will escape, the evacuation of which affords immediate and great relief to the patient. Putting the child to a breast in this condition naturally increases the accumulation of milk, and consequently the pain and swelling. If the tumour be not opened to let out the milk, ulceration of the skin will sometimes take place, and through the opening thus formed the milk will escape, and continue to flow during the whole time of lactation: this action is detrimental to the child, as by this means it loses a great portion of its nourishment. The openings established by ulceration of these tumours are often very difficult to heal, as they form sinuses which cannot be closed until lactation is stopped, after which, however, they generally heal readily.

Such cases as those last described do not frequently come under my care; but there is scarcely a season in which several cases of milk abscess are not admitted into this hospital under the surgeons. My own experience of this disease leads me to consider that unless the patient is in considerable suffering, and the constitutional symptoms urgent, it is better to allow the abscess to open by ulceration, for if the lancet be employed other abscesses are almost sure to follow, while the spontaneous opening seems to be permanently sufficient for the discharge. After the local inflammation is subdued in this disease, the patient will require both tonic and soothing remedies; but some difficulty may be experienced in healing the opening. The following case affords an example of this fact:—

A young married woman, who had lost her child about four months after its birth, was the subject of a chronic abscess in the breast, from which for two months a discharge of pus and milk continued to flow, and after that period a quantity of serum was constantly exuding; for the cure of these sinuses she was admitted into Guy's Hospital, but all the attempts at cure were ineffectual, until I passed a seton through the sinus, after which it rapidly healed.

Chronic inflammation of the breast.—This disease usually attacks persons from the age of puberty to the period at which the catamenia cease, the subjects are generally persons of strumous diathesis. In some cases the whole of the mamma is affected, but the inflammation and swelling are more generally confined to the areolar tissue between the lobules, the breast appearing as if numerous tumours were formed upon, rather than within, its substance.

When the whole of the mamma is affected it may be drawn forward from the chest, and feels like a firm rigid disc; if the organ is small, which it often is in these cases, I believe the induration to depend upon a morbid state of the gland tissue, and not of the areolar tissue.

The mammæ thus affected are tender, painful on pressure, and cause a constant sensation of uneasiness to the patient; the latter symptom is much increased during the period of menstruation, sometimes amounting to lancinating pain, shooting in the axilla or opposite breast: this pain is occasionally so severe as to lead the surgeon to suspect that the disease is of a malignant character; but the age of the patient, and the peculiar lobulated feel of the superficial moveable tumours, generally serve to distinguish it from carcinoma. It is somewhat difficult, however, under some circumstances, to distinguish it from fungus, as the absence of severe pain is a characteristic both of fungus and of chronic tumour; but in the latter the growth is very slow, while in fungus the increase of size takes place with great rapidity. When the breast is affected with chronic disease, it sometimes becomes concomitantly the seat of abscess: this may produce such an aggravation of the symptoms as to give rise to the opinion that the disorder is of malignant origin. I was once present with Sir Astley Cooper in consultation on a case in which the breast was about to be extirpated. Sir Astley recommended that an exploring incision should first be made in the tumour: it proved to be an abscess, and the breast was consequently saved.

The treatment I have found most effectual in this chronic induration is to apply occasionally three or four leeches, to use cold or tepid "lotio plumbi" poultices, and to keep the arm on the diseased side confined, so as to prevent motion: the strictest attention must be paid to the state of the secretions, and especially to the secretions of the uterus: if these be deranged, steel should be given: the patient should also be put upon generous diet, so that the powers of the constitution may be supported; but at the same time over stimulus must be carefully avoided. The medicine I have found most generally useful in this disease is the combination of ammonia and soda with bark, employing also narcotics at bed-time: if the bowels be inactive, especially if the inaction arise from sluggishness of the liver, small doses of blue pill, with colocynth and ipecacuanha, may be occasionally given.

I have known two or three cases of chronic inflammation of the breast go on to ulceration without the formation of abscess: and they terminated fatally. I could not regard these cases as malignant, although the patient fell a victim to the disease, for the effect was confined to the locality attacked, and did not propagate itself by means of the absorbents; neither did the ulceration put on the usual character of a malignant sore.

A lady, 30 years of age, consulted me in 1840 respecting a tumour in her breast. She stated that in June of that year she discovered, while dressing, the tumour, then about the size of a small apple. She had suffered no pain nor inconvenience, nor could she trace the formation of the tumour to any particular cause; it was perfectly moveable, and seemed to be immediately beneath the skin; she consulted a surgeon, who ordered leeches, evaporating lotions, and some kind of plaister, but she derived no benefit from the treatment. When I first saw the breast, it presented the following appearance:—It was at least one-third larger than the other, and slightly pendulous and superficial: the tumour seemed as if it were a growth additional to the mamma, rather than apart from it: to the touch it gave the idea of lobes separated from each other by intersections of fibrous bands: these characters induced me to pronounce the tumour non-malignant,—the age and diathesis of the patient also supported this view. Notwithstanding the pendulous form of the tumour, it was inseparable from the mammary gland, with which it was indeed so intimately blended as to have the character of hypertrophy of the natural lobes of the mamma. The tumour was now painful, particularly when touched; the nipple seemed as if slightly retracted, but, upon closer examination, this was found to arise from the projection of the surrounding parts, and not from a retraction of the nipple itself. Proper consideration of all the symptoms in this case led me to view it as one of "chronic inflammation of the breast," particularly as it was concomitant with a deranged uterine action, and attended with great pain at the time of menstruation. The growth of the tumour was more rapid than usual in chronic disease, but this perhaps depended upon the constitutional habit of the individual. The catamenia were natural as to period, but attended with more than usual pain, and often followed by leucorrhœa, and bearing-down of the uterus. I ordered the compound steel mixture, with compound decoction of aloes, and the application of a few leeches and poultices. I sent the patient to Brighton, and when she returned about six months afterwards, found that the breast had ulcerated, but the ulceration did not present a carcinomatous appearance. There was no enlargement of absorbent glands, nor any symptom of the disease in other parts of the body: there was a somewhat copious discharge, and at one point granulations protruded through the ulcer, presenting the appearance of the exuberant granulations in chronic abscess of the testicle. In the course of three months, the patient died, apparently from the exhausting effect of the disease upon the constitution. On a post-mortem examination, no disease was anywhere found at all resembling that in the breast: indeed, all the organs were healthy, with the exception of one of the kidnies, which was slightly granular, but not sufficiently diseased to account for death. A section of the breast showed the mammary lobes to be connected by a semi-solid medium, resembling imperfectly organized plasma, and towards the surface, in the vicinity of the nipple, some cysts were developed, containing granulations, surrounded by a small quantity of fluid. The existence of these cysts appeared to be the cause of the irregularity of the surface of the tumour.

Elizabeth Barber, æt. 43, was admitted into the hospital in July. She was a tall woman, of spare habit, sallow complexion, and dark hair and eyes: had been married about six years, and had had two miscarriages, the last occurring eighteen months before her admission. She commenced menstruating at eleven years of age, since which time her health had been good. When she came into the hospital, she had a tumour in the right breast, which had existed three years and a half. When first detected it was about the size of a large hazel-nut, it did not occasion any uneasiness until two months afterwards, when it began to itch: this was accompanied by a dragging sensation, felt particularly at the upper part of the breast, and which always became worse just before the menstrual period. The tumour increased slowly up to the time of her last miscarriage, since which time it had grown very rapidly. Within a few weeks of her coming to the hospital, the breast had become much worse, the dragging sensation frequently continuing during the greater part of the day, and being attended with sharp darting pains. The breasts were both very small. In the right there existed a tumour about the size of an egg, extending laterally towards the axilla: it felt hard and nodulated, was quite moveable, and painful on pressure. The nipple was not implicated in the disease; the patient never remembered having received a blow on the breast. A few days after coming into the hospital the catamenia commenced, two days before which the pain in the breast had been very severe. On the 10th of August I removed the tumour, which was found, on examination, to be a simple chronic mammary tumour. There was but little bleeding at the time, but secondary hæmorrhage came on afterwards: it was, however, easily checked, the wound healed by granulation, and on the 30th of August she left the hospital quite cured.

Irritable mamma, or neuralgia of the breast.—This is a disease which attacks young persons from the period of puberty to the age of 30 or 35 years, and does not appear peculiar to any temperament. Sir Astley Cooper states that this disease may occur without any perceptible swelling; or there may be a distinct tumour composed of a structure somewhat resembling that of the mammary gland, and being therefore an adventitious growth. I shall describe this disease as I have myself often met with it. I should be inclined to think that it generally attacks young women from 15 to 20 years of age, of rather a full habit, and sanguine temperament. I have generally seen it accompanied by enlargement of either one or both mammæ, as if they were preternaturally developed; but this is rarely attended by any tumour, although it sometimes happens that some of the lobules of the affected gland are slightly enlarged and hardened. Under these circumstances the breast is extremely sensitive, so that the patient is intolerant of the slightest touch, the pressure of the dress being sufficient to cause great aggravation of the pain, which is not confined to the breast, but extends into the axilla, and along the inner part of the arm of the affected side. The patient also complains of pain between the scapulæ, and cannot bear the least pressure on the dorsal vertebræ. Respiration is hurried and painful, and there is frequently a tendency to hysteria. Menstruation is usually scanty and painful, but during this period the pain in the breast is lessened; leucorrhœa is also a frequent concomitant. These symptoms are frequently protracted, and very difficult to relieve. The following is the plan I usually adopt in these cases. If the patient be of a full plethoric habit, I first order a few leeches to be applied to the breast, and afterwards a fomentation of camomile flowers and poppy-heads. The next day I apply a large blister between the scapulæ; and if the pain in this region has formed an urgent symptom, I recommend the blister to be kept open for three or four days; but to render these local remedies of any service, the leucorrhœa must be checked. This may generally be effected by an astringent injection. The best I know is composed of alum, and decoction of oak bark; one drachm of alum, to ten ounces of decoction. Belladonna and conium, plaisters and poultices, are also recommended, but I have found that their offensive smell excites nausea, and so much general annoyance, as to more than counterbalance the advantage derived from their narcotic influence. Internally, steel and other tonics may be given, and where nausea is a prominent symptom, these remedies may be administered in a state of effervescence. An opiate should likewise be ordered at bedtime. Tepid shower baths are sometimes found useful; but change of scene and air, particularly that of the sea-side, will be found the most effectual of all remedies.

I do not believe that this irritable condition of the breast often leads to the formation of tumours, and when they are concomitant with it, they are the cause, and not the effect, of the irritability. This view seems strengthened by the fact that ordinary strumous swellings are sometimes attended by these neuralgic pains, in persons of irritable temperament. I look upon the performance of the natural function of the breast as the most certain cure of this disease; it is but very rarely seen in married women, especially if they have borne children. I have lately had two of these cases under my care, but as all the symptoms have been already described, it would be useless to merely individualize the cases by mentioning the names of the patients.

Hypertrophy of the mammæ.—This is not an uncommon condition, and is frequently unattended by any constitutional derangement, consisting only in a general hyperæmiated state of the breast; at the same time, the superabundant growth may originate either in the gland itself, or in its areolated tissue, or in its fatty structure.

The natural increase of the breast takes place at the period of puberty, and it undergoes a certain degree of periodical enlargement during menstruation; under the influence of uterine gestation also, it is subject naturally to become enlarged. As the breast is thus liable to excitation from different causes, it cannot be surprising that an interruption to the equilibrium of nutrition should lead to a permanent excess of development in some one or all the tissues of this organ. Hypertrophy of the breast chiefly attacks young women of sanguineous temperament, seldom appearing after the age of thirty. Married and single appear to be equally subject to the disease, and where the breast may have escaped the morbid development, under the influence of menstruation alone, in a state of celibacy; the superior excitement arising from approaching lactation may often produce it. In this disease the breast retains its natural form, although its size is increased; one breast may alone be affected, or at least the disease may only subsequently extend to the other. I remember a case in which a young lady of rank, æt. 15, was brought to Sir Astley Cooper under such circumstances; her mother was much alarmed on discovering that the left breast had undergone a very considerable enlargement, while that on the other side showed scarcely any signs of approaching development. Upon examination, Sir Astley Cooper perceived immediately that it was mere hypertrophy of the breast at the age of puberty, and that it was not accompanied by any diseased action. He explained the nature of the case to the mother of the patient, pointing out the innoxious character of the phenomenon: but although her fears were set at rest with respect to her daughter's life being in danger, she was still somewhat doubtful whether a permanent deformity might not remain from the unsymmetrical development of the breasts. In the course of due time, however, the right breast began likewise to increase in size, and shortly attained an equal bulk with that originally hypertrophied. When the hypertrophied breast is examined by the touch, nothing abnormal can be felt; it gives the idea of a general enlargement of the natural structures of the gland, and the only inconvenience complained of in this disease, is the great weight, which sometimes renders it necessary to furnish support to the part. If the enlargement depends upon approaching lactation, it may be expected that the breast will be restored to its natural size when suckling commences; it will also then be found that the quantity of milk corresponds in some degree with the size of the secreting apparatus. When the morbid growth is caused by some agency independent of approaching lactation, and the breast cannot be relieved, as in that case, by a flow of milk, the increase of bulk may gradually go on until it may be necessary to extirpate the whole organ; when this extreme measure is not required, the remedial indications seem to be, continued gentle antiphlogistic treatment, abstinence from over nutrition, quietude, and proper attention to the maintenance of the secretions. Shower-baths, alteratives, emmenagogues, and tonics must also be employed.

The breast is sometimes subject to hypertrophy of its fatty structure, a disease not unlike steatoma in other parts of the body;

the removal of the fat lobes is the only treatment in such cases: if, however, the patient be pregnant when the disease first makes its appearance, it would be advisable to wait until lactation has ceased before the operation is performed, not only from fear of injuring the child, but from the hope that the fat may become absorbed in consequence of the pressure of the milk in the gland during the period of lactation.

Atrophy of the mammæ.—This change naturally takes place to a greater or less extent after menstruation has ceased, and is most remarkable in women who have never borne children. An abnormal diminution in the size of the breast sometimes takes place, however, not merely from the absorption of fat, but from wasting of the mammary gland itself. This kind of atrophy sometimes occurs from a long continuance of the irritable condition just described, as if the affection of the nerves interfered with the nutrition of the organ. The same phenomenon is seen in irritable testicle. If the breast be examined under these circumstances, and when atrophied from old age, it will be found that the excreting part of the organ alone remains, the glandular structure being entirely absorbed. It has been stated that the cumulative influence of iodine will produce this atrophied state, both of the mammæ and testicle; but although I have seen considerable quantities of this agent employed through a course of many years, I have never witnessed any instance of this alleged effect.

In atrophied breast, medicines can avail but little, unless it arise from a general state of anæmia, when perhaps steel, sea-air, and generous diet, may be useful, by improving the constitutional powers of the patient.

Hydatid breast.—This is a very rare form of breast disease, if the term be intended to imply the existence of living entozoa within the mamma; but if it be expressive only of the presence of cysts containing solid or fluid matter, it is of more frequent occurrence; in the latter case the more correct designation is, in my opinion, the *sero-cystiform disease.*

True hydatid breast.—Nothing is known of the manner in which animalcules are generated within the structures of living animals; certain it is, however, that they do so exist, and are sometimes found in the mammæ as well as in other organs. When generated in the human breast, inflammation soon becomes excited, and a distinct fibrinous cyst is thrown out around the animalcule, producing a tumour, which goes on increasing in size, until at length fluctuation can be distinguished in its central part; but it is not attended by pain or inconvenience of any kind beyond that arising from the presence of an abnormal growth in such an organ. If the cyst be not removed, it ulcerates, and the hydatids are discharged spontaneously; after which the wound heals.

In speaking of the treatment of this disease, Sir Astley Cooper recommends that an opening should be made into the tumour, for the purpose of discharging the hydatids; after which he says that a common poultice will be sufficient to heal the wound; but that when the fluid alone is allowed to escape, and the cyst left behind, the fluid will re-accumulate: a seton should therefore be passed through the cyst; this produces sloughing of the part; the hydatid is removed, and the wound afterwards readily heals.

The hydatid breast is not malignant, the disease is not propagated to distant parts, nor does it return after it has been removed by extirpation. One of the principal distinctions between true hydatid breast and sero-cystiform disease is the facility with which the capsule of the hydatid escapes even after its fluid has been evacuated, whether the opening be made artificially, or has arisen spontaneously; while in the sero-cystiform disease the cyst adheres obstinately, and continues to secrete its peculiar effusion until it is extirpated by the knife.

In Oct. 1846, I admitted a woman, æt. 51, with a tumour in the left breast. At the time of her admission, it had existed for six years; it was quite firm, but not hard; it had never been painful, and the woman wished to have it removed, merely on account of the annoyance it caused by its size. When an incision was made into the tumour, a clear fluid escaped, and the cyst resembled that of an hydatid. Under the microscope echinococci were detected, and a great number of the spines peculiar to these animalcules were found floating in the fluid.

Sero-cystiform tumour of the breast.—This disease was described by Sir Astley Cooper as hydatid breast, and by some pathologists it has been considered analogous to encysted hydrocele. It differs, however, from both those diseases: from the former, in not containing animalculæ; from the latter, in the cysts being connected with each other by stalks or roots of fibrous processes, originating in the areolar tissue of the breast itself, instead of being completely separate and distinct. The cysts are supposed to proceed from the dilatation of the lacteal tubes; but what I have seen of this disease induces me to view them as formed of a totally new structure.

In its external character this disease is so similar to true hydatid tumour, that it is very difficult to distinguish one from the other: the swelling in both cases is of a globular form, sometimes slow in the progress of its growth, unattended by pain, discoloration of the skin, or any constitutional disturbance. To the touch, the sero-cystic breast feels as if small fluctuating tumours were imbedded in its structure, varying from the size of a pea to that of a large walnut. As the disease advances, the original structure of the breast becomes more and more obscure. If one of the cysts be opened, it will be found to contain a clear straw-coloured fluid, very coagulable by heat, and differing in that respect from the fluid of encysted hydrocele, to which, as I have already said, some surgeons have considered this disease similar. The fluid of the cyst is sometimes, however, found to be opaque, viscid, or sanious: when the latter condition presents itself, it becomes very difficult to distinguish the sero-cystiform disease from fungoid. After the fluid has been evacuated, it is quickly reproduced, and the diminution of the tumour is therefore but temporary. When a cyst has been emptied by puncture, its character sometimes becomes altered: it thickens, or even granulates, so that it becomes converted into a comparatively solid tumour: in this stage the swelling begins to create an uneasy sensation; the whole breast assumes the character of "chronic tumour;" and if at this period it be not extirpated, the skin becomes involved, and ulcerates; at the same time the constitution remains but little affected.

Neither local nor constitutional remedies appear to possess the slightest power over this disease, the only available means of treatment consisting in its extirpation; but even here a successful issue ought not too confidently to be expected, as, from the difficulty of the diagnosis, it is impossible to say that a carcinomatous tubercle is not concomitant with the sero-cystic affection: this is sometimes the case, and under such circumstances the disease would doubtless prove fatal. A case of this kind is described by Sir Astley Cooper. An unmarried lady, 34 years of age, consulted him for a swelling in the breast which she had discovered about a year previously; the tumour had all the physical characters of the sero-cystiform disease, but was somewhat harder than usual. The breast was extirpated. Upon afterwards laying open the tumour, it was found to be made up of numerous cysts, some of which were filled with fluid, varying in colour and consistence; while others contained solid matter, and a tumour of considerable size was situated above the nipple. The patient quickly recovered from the operation; but twelve months after, the disease returned in the cicatrix, and she died in a short time with all the symptoms of cancer. The cystiform disease itself is not, however, malignant. I have seen several cases in which it has been effectually removed, never afterwards reappearing. An interesting case of this kind is published by Sir Astley Cooper: it was that of Lady Hewitt, whose breast, after amputation, weighed nine pounds. A drawing of this tumour is given in Sir Astley Cooper's monograph on non-malignant diseases of the breast.

Ecchymosis of the breast is a disease spoken of by Sir Astley Cooper; it is very rare, but as it is admitted into the category of morbid conditions of the breast, I must not leave it altogether unnoticed. It is evidently a strong instance of the sympathy between the uterus and the mammæ, and is said to be generally concomitant with a diminution of the menstrual discharge, and would seem to indicate as a consequence an unnatural flow of blood to the breast, producing the ecchymosed appearance. The subjects of this disease are of a highly irritable temperament, and from the symptoms it would appear that they are of an hæmorrhagic diathesis. The treatment must be directed to the improvement of the general health, and especial attention should be paid to the functions of the uterus. Steel, bark, and mineral acids, generous diet, and pure air, would probably be found the best remedies.

In August, 1848, a woman was admitted into Guy's Hospital with a small nodulated tumour on the right breast: it was moveable, and seemed to be made up of interlobular effusions of considerable hardness; the breast was painful, especially at the period of menstruation, which function was but imperfectly performed. The patient was anxious that the tumour should be removed, and I performed the operation on the tenth day after her admission. Upon dissection, the tumour was found to be composed of effusions of blood deposited in the areolar tissue of the breast in irregular masses, forming the numerous tumours which were evident to the touch. As the patient had received a blow upon the breast, it is a question whether the effusion of blood depended upon that cause, or whether it was the result of a vicarious discharge of blood depending on interruption to the uterine function.

LECTURE LV.

CONTINUATION OF DISEASES OF THE BREAST.

Malignant diseases of the breast—Difficult of definition—Dependent upon peculiarity of diathesis—Carcinomatous tubercle of the mamma—Manner in which the disease commences—Its progress, symptoms—Physical effects—Its different stages — Adhesion, suppuration, ulceration, gangrene—Effects of carcinoma on the constitution—Case—Cause of carcinoma may be either predisposing or exciting—Slight circumstances sufficient to produce the disease when the diathesis is malignant.

MALIGNANT DISEASES OF THE BREAST.

I HAVE now described the most important of the diseases of the breast which have no malignant tendency,—and I shall proceed to the consideration of those having a malignant character, which are uncontrollable by any known system of medical or surgical treatment, and which, from the moment of their development, go on increasing with greater or less rapidity, to the ultimate destruction of the life of the individual attacked.

It is very difficult to define precisely what is meant by the term malignant disease, and equally so to recognise it with certainty when presented to the view, as the physical conditions of a non-malignant and highly malignant tumour may be so similar as almost to preclude the possibility of distinguishing one from the other. We must regard tumours as of two kinds; those that differ in nature and consistence from the surrounding tissues, and those that are similar to the parts whence they have their origin. It does not follow, however, that either of these classes is malignant: they may rapidly increase in size, so as to destroy the function of the organs among which they are seated, and yet they may in nowise interfere with the constitutional powers of the individual, nor go on to the ultimate destruction of life. The malignant tumour, on the other hand, not only differs from the neighbouring structures, but possesses an indefinite tendency to increase, to ulcerate, and, above all, to propagate itself to distant parts of the body through the medium of the absorbents or veins, or perhaps both. The long and generally-received doctrine that the diseases known as cancerous can only be developed in constitutions of a peculiar or specific kind, which have, indeed, been distinguished as the "malignant diathesis," is one which, in my opinion, ought to be adopted by the pathologist with great caution, and not without due and sufficient consideration of the subject: for my own part I cannot help thinking that it is a mistake to attribute the primary development of cancer to a specific diathesis, and to the pre-existence of a peculiar poison in the blood, and that the term "malignant diathesis" is indefinite, and therefore unscientific, and ought to be expunged from pathological nomenclature. It has never been shown that the form of constitution in which cancer occurs is different in any tangible respect from that expressed by "cachectic;" it is doubtless a bad, an unsound condition of constitution, one in which the vital action is somehow or other below the normal standard; but I cannot believe that any proof can be found of the existence of a specific condition under which alone cancer can be developed. If we examine with the microscope the matter developed during the growth of cancer, what are its chief characteristics — the absence of everything like regular organized tissue—an accumulation of granular corpuscles, mixed perhaps with detached epithelium, the former unlike the corpuscular foundation of any of the normal tissues or fluids, and having precisely the appearance of the fungous cellular growths which are developed in a solution of decaying vegetable matter; in the latter instance these fungous granules are evidently the result of the resolution of a vegetable product of a high class, such as starch and gluten, into one of the very lowest type: is it not possible that what is termed malignant development in the animal structures is produced by changes similar in character to those which take place in vegetable matter, in which the conservative principle of vitality is no longer present—is it not possible that continued local disease reacting upon a constitution in which the vital power is, from any cause, at a low ebb, may still further diminish that vital force and induce a condition of cachexia in which the parts already deteriorated by local disease are no longer capable of appropriating the constituents of the blood to the formation of normal tissue; and that instead of the parts being equal in tone to the other portions of the system, a lower kind of organic life is carried on, of which the characteristic fungoid granules are the indication. Chimney-sweepers' cancer, and the warty excrescences in the face, which often put on a malignant action, as it is termed, are instances of diseases which are generally believed to commence in a non-malignant form, and which are supposed to be capable of effectual cure by extirpation; but both these diseases, especially chimney-sweepers' cancer, often assume characters of the most inveterate malignancy, and if not early removed, ultimately destroy the patient.

It may be said that cancer pervades the whole system, and that its great peculiarity consists in its germs being conveyed from one locality to another. There is nothing in this which discountenances the view that cancer may be originally a local disease; the cancer cells have been discovered in the blood of the part affected, as in the blood of a cancerous testis. Surely the presence in the blood of matter so foreign to the system is sufficient to account for contamination of the whole organism. Pus in blood (and pus is a substance derivable from the blood in healthy constitutions, and more closely assimilating to it than this cancerous matter can possibly do) is productive of dangerous and violent symptoms; can we not, then, understand that these fungous granules, once absorbed into the blood and possessing the property of self-multiplying, would be a certain means of still further depressing an unhealthy constitution and of maintaining that local action in which the mischief had originally commenced? The effects of the sausage poison (so well known in Germany) is a good instance of the changes which may be produced in the blood by the influence of matter itself in a state of putrefactive fermentation; who can doubt that the effect of the introduction of any such matter, whether derived from a source external to the system, or generated in some portion of its own organization, would be to promote a universal unnatural condition through the whole organismus? This effect would be indicated by a train of symptoms marking a deviation from health; and may depend equally upon local injury, or upon the constitutional deterioration.

In healthy constitutions these sudden derangements are overcome by the vital energy, and the equilibrium temporarily disturbed is soon re-established between the blood and the tissues the recipients of its constituents; in a cachectic habit the restoration cannot be effected, and permanent disease is consequently established. In health, when either a formative or restorative action is excited, there is always a due regard to the proportion between the increased action of the vessels, and the necessity for the supply to the tissue to be formed or restored: as soon as the reparation is completed, the increased action ceases, the parts being restored to their healthy condition. I cannot give a better instance of an action of this temporary kind than that arising during the excitement of the mammæ at the period of menstruation. None of the ordinary consequences of inflammation follow this action, but there can be no doubt that the mammæ are thus prepared for their important office of lactation. At the same time is it not probable that to this frequent excitement, and the non-performance of the function to which it is intended to be preparatory, may be traced, at least in some degree, the tendency to malignant breast disease so often encountered in unmarried women?

CARCINOMATOUS TUBERCLE OF THE MAMMÆ.

The early symptoms of this disease are generally described by the patient as follows:—The presence of the tumour in the breast is often first discovered by accident. It has the form of a small hard knot about the size of a marble; perhaps the patient was led to examine the bosom in consequence of an uneasiness in some part of it, or the disease may have been detected from a red stain being found upon the linen; this would naturally lead to an investigation, when it would be discovered that, on pressure, a small quantity of sanious fluid may be squeezed from the nipple. This symptom is not, however, truly pathognomonic of carcinoma, for it is frequently found in chronic inflammation of the mamma. The above symptoms may be regarded as indicative of the first stage of "carcinomatous inflammation." This term appears to me very appropriate, as the abnormal action is in many respects similar to common inflammation, the result being in either case an adhesive, suppurative, ulcerative, or gangrenous process; but instead of these being, as in health, reparative, they lead to the destruction of the tissues affected by the abnormal irritation, and this destructive action ends only with the life of the unfortunate sufferer.

The deposition of the carcinomatous tubercle is the result of an adhesive process, but the plasma deposited is of an unhealthy character ("cacoplastic,") and inorganizable, as far as refers to the tissues in which it is deposited, and into which it is incapable of being developed. This action is sufficient to prove the presence of disease; for in a healthy state of the constitution, the capillaries of each structure eliminate from the blood such constituents only as are fitted for the tissue which they are intended to nourish; while in the diseased state just described, a new element is eliminated, remarkable for its excessive and unnatural hardness, and the continual irritation it produces in the part. This condition is usually attended by an increased determination of blood to the part, and by the ordinary phenomena in increased action, redness, swelling, heat, and pain. Carcinoma generally increases very slowly, and this is one of the characteristic features of the disease, and too often tends to lull the apprehensions of the patient, and prevents her early applying for medical assistance at the only period, indeed, at which benefit could be hoped for. Although the growth of these tumours is gradual, it goes on insidiously, and, after a time, the part becomes painful; the pain is also of a very peculiar kind—lancinating, as it is termed. This marks the progress of the disease, and it is generally observed that at this stage the swelling and pain increase just before the time of menstruation, and become mitigated when that time arrives.

As the tumour increases the nipple often becomes retracted; nor does this depend upon an unnatural fulness of the breast, by which the nipple is buried, as it were; but the tension of the lactiferous tubes sets up a diseased action, in consequence of which they become shortened, or rather perhaps a deposit of lymph destroys their elasticity, and prevents their extending with the growth of the breast. A discharge from the nipple frequently takes place at this stage of the disease; but this, as I have remarked before, does not prove it to be malignant. The retraction of the nipple is often followed by a puckering in of the skin: from the adhesion and infiltration of the integuments. This action gives the skin the appearance of cicatrices, which are sometimes so strongly marked as to lead to the belief that a surgical operation had been previously performed. The skin about the nipple often partakes of the characteristic hardness of the mammary tumour: a sign of the inveterate malignancy of the disease. The follicles around the nipple become enlarged, and filled with sebaceous matter of a black colour, and by which they are rendered peculiarly conspicuous. The absorbent vessels are likewise liable to become indurated; and, on attempting to raise the arm from the side, considerable pain is experienced, extending towards the axilla; or, if the tumour be situated between the nipple and the sternum, the stretching of the pectoral muscle gives pain towards the cartilages of the ribs, indicating the progress of the disease to the absorbent glands of the anterior mediastinum; less frequently, the pain will extend towards the scapula on the affected side, showing the absorption of malignant matter in that direction. The tumour, through all its stages, goes on increasing in size, the surrounding parts becoming more affected from fresh effusions of contaminated adhesive matter; the absorbent glands also become enlarged; the severity of the pain increases,—although there will be periods of comparative ease,—and the general health begins to give way. The adhesive action seems now to have gone to its extreme limit; the adventitious induration in the breast becomes a source of irritation to the surrounding tissues, and the suppurative stage of the disease commences.

Suppuration in cancer.—The process of suppuration does not always precede ulceration; indeed, the actual formation of pus is rare in this disease; nevertheless there is usually to be found an indistinct fluctuation in some part of the tumour before the skin ulcerates; although the fluid which escapes from the tumour, whether the opening be factitious or formed spontaneously, bears but slight resemblance to true pus. The microscope may in such a case be usefully employed to aid in forming the diagnosis. During this kind of suppurative process or softening down of tissue before ulceration, the character of the pain becomes much altered, being now rather throbbing and burning than acute; the discharge, when it takes place, frequently irritates the skin, producing an erythematous blush; and, indeed, a distinct attack of erysipelas sometimes supervenes. Both local and constitutional means must be adopted to subdue this fresh source of irritation; and, as a preventive to the excoriating action of the discharge, it will be found a good plan to cover the surrounding skin with some simple ointment. Constitutionally there can be little done beyond allaying to some extent the pain by the use of narcotics, and maintaining the vital powers by tonics and generous diet. The opening through which the matter discharges itself increases in size, and very shortly ulceration commences.

Ulceration in cancer.—This proceeds with greater or less rapidity, according to the constitution of the patient; but its pathognomonic character is to advance slowly. The ulceration not only extends itself over the surface, but interstitially into the mass of the tumour, dividing it into granulating lobules, which are spongy in their texture, and bleed readily. This stage of cancer is attended by a gnawing pain, which appears to be considerably relieved by the bleedings that occasionally occur, although at the same time the loss of blood lowers the patient, and increases her irritability. Under these circumstances, opium and other soothing remedies are indicated. The hæmorrhage from the ulcerations is easily checked by means of a pledget of lint dipped in cold water, or a piece of ice applied with slight pressure. The glands which were affected in the first stage of the disease continue progressively to increase in size; unless they have become involved in the ulceration, the supraclavicular glands are generally the first affected.

The health of the patient now becomes seriously impaired, and every vital function more or less interrupted. A cough frequently indicates that the contamination has extended to the lungs; uneasy sensations are experienced in the region of the stomach, and loss of appetite supervenes. The rest is destroyed by rheumatic pains in the bones, which are even sometimes broken by the slightest application of force; indeed, when the disease has attained this stage in its progress, it appears that every structure in the body has become implicated in the general deterioration. These urgent symptoms sometimes, however develope themselves even before ulceration has commenced.

During ulceration there is always some attempt on the part of nature to fill up the sores by granulation, but the granulations themselves are marked by the malignant character of the disease. They are unhealthy in appearance, irregular in their growth and vascularity, and possessed only of a slight degree of sensitiveness, for although there may be considerable pain, it will be found that this arises from the exposure of the sentient extremities of the nerves in the ulcerative process. The pain is most readily subdued by the application of the nitrate of silver in solution. The cancerous granulations have a great tendency to become everted instead of converging, as in the action resulting from common granulations, which convergence leads to cicatrization, while eversion of the edges of the wound prevents the possibility of its healing. If, under these circumstances, any fresh source of excitement arises which it exceeds the power of the granulations to sustain, they give way, and then commences the *gangrenous stage of scirrhus;* the general character of the sore is now at once altered, it loses its red appearance, and its irregularities are no longer to be observed, but it presents one deep excavation having a greyish or slate-coloured surface; the pain is much diminished, and most of the urgent symptoms seem to be relieved. In the course of a few days a slough is perhaps thrown off, and an apparently healthy surface exposed: this change often leads to the delusive hope that a healthy condition is being re-established: such hope proves, however, but short-lived; the malignant action returns with increased severity, the constitution suffers still more, and the patient now soon sinks, utterly worn out by the constant suffering to which she had been so long exposed.

The effects of carcinoma on the constitution during its progress are more or less characteristic of the local morbid changes that take place; for instance, during the adhesive stage, while the deposition of the adventitious induration is going on, there is more or less febrile action, indicated by a quickened pulse, diminished secretions, and thirst; and there is also a peculiar cachectic appearance; the complexion is sallow, and although the extent of constitutional derangement is not by any means commensurate with the local deterioration, yet there is generally sufficient evidence of deviation from a natural action to excite a suspicion of danger in the surgeon's mind. During the suppurative process a new train of symptoms arises, somewhat resembling those in the formation of abscess: there is, however, only an attempt at the formation of pus, for the effusion produced differs entirely from it. The rigor is indistinct, the pain very peculiar, and the fluctuation doubtful. The question now arises as to whether mere disintegration, premonitory of ulceration, is going on, or whether matter is actually forming; at any rate, poultices, fomentations, narcotics, and tonics, are indicated: probably at this time difficulty of breathing, disordered function of the liver or stomach, with pains similar to those in rheumatism, are complained of, and must be relieved by appropriate remedies. If the indurated mamma has acquired a considerable size and hardness, and presses on the absorbents so as to produce their obliteration, or infiltrate the lymphatic glands, swelling of the arm on the affected side will add greatly to the suffering of the patient, and an aggravation of the constitutional symptoms necessarily results. The ulcerative stage is marked by a fresh train of symptoms; the arterial action seems now to be diminished, and that of the absorbents to be proportionally increased; it is at this time that the propagation of the disease to distant parts is especially effected, and the organ which is the subject of this extension of the disorder is recognised by the interference with the performance of some peculiar function: as under these circumstances disorganization must have taken place, no benefit can be derived from any attempt to relieve the functional disturbance, and the progress of the disease will continue with greater or less rapidity, according to the amount of vital power possessed by the patient. The extension of the ulceration (which sometimes goes on rapidly) adds greatly to the suffering of the patient, not only from the exposure of a large ulcerating surface and its consequent discharge, but also on account of the fœtid odour arising from it, and which is almost insufferable to the patient, and renders it impossible for others to remain long near her person; a weak solution of chloride of zinc is perhaps the best application that can be employed in these offensive ulcers, as it removes the smell, and induces a more healthy action in the ulcer itself. The arm should be confined to the side, as its motion irritates the sore, produces pain, liability to bleed, and sometimes sloughing; the latter condition may arise either from a local altered condition of the sore, or from diminished constitutional power; but whatever may be its cause, it indicates the close approach of the fatal termination to the disease. Elizabeth Hounslow, æt. 42, was admitted on the 7th of July, 1848, with a small moveable scirrhous tumour in the left breast; it was attended by lancinating pain darting towards the opposite mamma; her general appearance was cachectic, perhaps to an extent that would warrant the application of the term "malignant diathesis." The disease had made its appearance shortly after the cessation of menstruation: she had had but one child (still-born), and that was thirteen years before. The disease commenced about two years previously. I extirpated the tumour, which presented upon dissection all the usual signs of true scirrhus, having a hardened centre like a nucleus, from which diverged radiating lines running towards the circumference of the mamma. None of the absorbent glands were enlarged, and for six weeks after the operation the patient seemed to do well, when just as the wound had cicatrized, a small hardened tubercle appeared at its outer angle, but as this was perfectly moveable, I excised it also. The second wound never healed, but ulceration of the old cicatrix now came on; the glands in the axilla became enlarged, the left arm swollen and œdematous; and lancinating pain increased, and was attended by nocturnal rheumatic achings in the bones of the affected arm. Her rest was so much interfered with in consequence of these symptoms, that her constitution became much impaired, and a sloughing supervened, which so destroyed the morbid granulations, that it was difficult to distinguish it as a case of scirrhous disease. A fresh tubercle soon formed on the sternum, and this seemed to check the progress of the ulceration. She then complained of frequent cough, attended by distressing dyspnœa; these symptoms were somewhat alleviated by opium; her appetite next failed her, and she was only able to take a little bread dipped in wine. Four or five months from the time of the original operation, she died, and upon a post-mortem examination her lungs were found much diseased; a large malignant tumour existed in the right lobe of the liver, and scarcely an organ in her body presented a healthy appearance.

This case afforded, during its progress, a good illustration of carcinoma in its various stages; but both the physical condition and constitutional symptoms are subject, in this disease, to great modification, according to the age and temperament of the individual, and the accidental circumstances under which the disorder first makes its appearance. Sometimes carcinoma commences as a tubercle, forming a hard, isolated, moveable tumour, attended with but slight pain, and that only occurring occasionally; nevertheless, the pain manifests that lancinating character so peculiar to malignant affections. The commencement of the disease is probably unattended by any premonitory sign of inflammation, but it advances by insidious steps, the skin soon becoming adherent and puckered.

Such is the progress of the disorder as it usually occurs in spare unmarried women, at about the age of sixty; in those subjects, indeed, who possess no inflammatory tendency, and in whom the development of the diseased structure is consequently very slow. These tumours should not, I think, be extirpated, but the constitutional powers of the patient maintained by every means at the disposal of the surgeon; and if proper precaution be observed to prevent the accession of any source of irritation, the disease may remain in abeyance as it were for many years; while a surgical operation tends to excite a new local action, which secondarily affecting the constitution, goes on with great rapidity, and the death of the patient is hastened instead of being retarded.

Upon the examination of a carcinomatous tumour after its removal, it will be found composed of a deposition of a peculiar indurated material effused into the areolar tissue of the mamma, and not in the lobes themselves; the latter will, indeed, during the early stage of the disease, often be found wholly uncontaminated. As the disease advances, the excretory ducts of the mamma become compressed, no traces of them being left; and ultimately all the structures become converted into one carcinomatous mass. Carcinoma sometimes commences with symptoms of considerable local inflammation: in that case, the areolar tissue of the whole breast becomes almost simultaneously infiltrated: this may, perhaps, be rather considered as a state of acute carcinomatous inflammation, than as one of carcinomatous tubercle. This kind of malignant action attacks women at an earlier period of life than the tubercle, and the subjects are also generally of a more sanguineous temperament. In these cases, the glands in the axilla become much earlier implicated: the skin ulcerates sooner, but there is not the same tendency to retraction of the nipple, neither is there the excessive hardness so truly characteristic of carcinoma in its chronic form; the pain, although severe and more continued, is peculiar from its throbbing, as well as lancinating and shooting nature; and from the suffering experienced, the patient becomes conscious of the presence of the disease at a much earlier period of the attack. If in this form of the disease extirpation be determined on, the patient requires considerable preparation before the operation; and great care must be taken, in the removal of the breast, that the whole of the diseased structures be taken away. I need scarcely remark, that the operation ought to be performed before the axillary glands are affected, or the skin becomes adherent to the tumour, as these circumstances much lessen the chances of a successful result to the surgical treatment.

In acute attacks of carcinomatous inflammation the effusions are so rapidly formed, that they are frequently wanting in the stronger characteristic indications of malignant disease, both with respect to the physical and constitutional symptoms: considerable difficulty may therefore arise in the diagnosis. In going through the wards of an hospital, it may often be remarked that differences of opinion arise in cases of breast disease; this depends in great measure upon the rapidity with which the disorder has been developed. In women, after the age of fifty, who have lived in a state of celibacy, and who betray a generally cachectic condition, and are the subjects of small hardened moveable tumours in the breast, accompanied by lancinating pain, there is no difficulty in at once forming a judgment as to the nature of the disease; but where the affection has commenced before the cessation of menstruation, and in women who have married and borne children, it is difficult to determine whether the disease be malignant or not; it is, however, of the highest importance to ascertain, if possible, the true nature of the tumour, for if it should prove malignant, delay may admit of its propagation to some distant part, and then the removal of the breast would be no longer available. The enlargement of the axillary glands is not, however, invariably to preclude the operation, for that condition may proceed from ordinary irritation alone; this is particularly the case in the acute stage of the disease: the best test for ascertaining if the glandular swelling be the result of specific contamination, is the application of leeches and fomentations to the breast, to subdue the inflammatory action: if the swelling proceed from simple inflammation, it will subside under this treatment; but if it arise from malignant action, no benefit will accrue.

Upon dissection of a breast, affected by this form of scirrhous inflammation, the effusion will be found to differ very much as to its hardness, and although diffused over a large surface, it is still deposited in the "inter-lobular" tissue; but is frequently so soft in consistence as to resemble fungoid disease, and is also more vascular than the chronic circumscribed carcinoma.

I believe, indeed, that little or no distinction can be made between the deposit in carcinoma and that in fungoid disease, excepting with respect to the rapidity of growth, which depends more upon the constitutional peculiarities and power of the patient, than upon any specific character in the deposition itself. I have seen the dissection of a breast, removed under chronic inflammation, presenting an appearance so similar in every respect to that in scirrhous inflammation, that it was almost impossible to determine with certainty the character of the disease, the corroboration of the supposition that it was non-malignant being alone found in the circumstance of its not reappearing after the operation.

Blows on the breast, the excitement of this organ during the periods of menstruation or lactation, may tend to the development of scirrhous inflammation or tubercle; but I believe the most powerful of all exciting causes to be grief, and in eliciting the history of such cases, you will generally find that the subject traces the commencement of the malady to some severe mental distress. This cause probably operates, however, only so far as it impairs the powers of nutrition generally. As soon as the disease is established, and the affected mamma is increased beyond the natural size, it is rendered further liable to external injury; indeed, the complaint is often aggravated, and its progress hastened, by a blow; it is impossible to describe the innumerable circumstances that may prove exciting causes to carcinoma in the constitution where the specific tendency to it exists.

The length of time through which the life of a patient may be prolonged in malignant disease, must depend in great measure upon her vital power, and the slowness with which the disease is propagated, and also upon the importance of the organ which ultimately becomes affected. The lungs are, perhaps, most frequently implicated by the secondary action, especially in persons who have a phthisical tendency; the uterus and ovaria are also very often affected; indeed, there is scarcely an organ or tissue that may not become secondarily the subject of cancer.

The period at which dissolution supervenes depends, of course, upon the importance of the function of the organ attacked: death, however, sometimes occurs from the constitutional irritation excited by the local affection itself, and this may arise from the constant acute pain producing want of rest, or from the discharge during the ulceration causing a drain upon the system which destroys the constitutional powers: under these circumstances death may result without the disease having been propagated to distant parts of the system, although there can be no doubt that the disintegration produced by ulceration may tend to the deposition in other tissues. In carcinomatous tubercle of the breast I have known a patient live for many years, suffering only occasionally from lancinating pains: these may often be mitigated by soothing remedies, and the occasional application of two or three leeches, the arm on the affected side being kept in a perfect state of rest. Some years ago I was called in to a case of a lady at Camberwell, who had been under the care of Mr. Arnold for four or five years, with scirrhous enlargement of one of her breasts: the disease had been kept quiescent by occasional leeching and poulticing, but at length it began to increase, and became more painful. I consequently extirpated the tumour, and the patient remained quite well for ten years; at the end of that time the disease returned in the cicatrix, and ultimately destroyed her life. In another case, a lady, about 48 years of age, a patient of Mr. Rowe, of Woburn-place, was the subject of small scirrhous tumour of the breast, which had existed for four years without having undergone any change, excepting a slight increase in size: at this time she accidentally received a blow on the diseased breast; the tumour then began to increase with great rapidity, and became very painful. I ordered leeches, poultices, and fomentations, but she derived no benefit from them, and I therefore removed the tumour. Eight years after, the disease had not returned, although, upon dissection of the indurated mass, it presented every appearance of the true scirrhous tubercle. I have, indeed, no doubt of its having been so; nor is the fact in this case inconsistent with what I have said of the nature of the disease; it only proves, that although the patient may be the subject of a malignant diathesis, the tendency may remain long dormant under certain conditions; until, indeed, it be roused into action by some sufficient exciting cause.

When the disease assumes the more active form of acute scirrhous inflammation, extirpation is rarely successful, even as a means of prolonging life, as the operation itself is sufficient to create a further development of the disease; even under the attempted restorative inflammation, cacoplastic instead of healthy matter is deposited; and further, under this new action it generally follows that the disease is propagated to other parts of the body, and quickly proceeds to a fatal termination.

Mr. Gosse, of Hoddesdon, consulted me respecting a patient who had an ulcerated scirrhous breast, in which she was suffering great pain, and which was discharging profusely. As the glands in the axilla were not enlarged, Mr. Gosse agreed with me that extirpation offered the only chance of prolonging the life of the patient. She consented to the operation, and I performed it in August, 1838. The wound had scarcely healed when the disease reappeared, rather, however, under the fungoid than the scirrhous form, and she died in six months from the time of the operation. Indeed, from what I have seen of diseases of this class, I conclude that but slight hope can be entertained of recovery by the extirpation of a tumour when in a state of ulceration, and the only reason for recommending such a mode of procedure would be the removal of the great misery and pain arising from such a large ulcerated surface, and checking the profuse discharge so generally concomitant with ulceration, and in addition, the probability, remote as it may be, of prolonging the life of the patient.

LECTURE LVI.

CONTINUATION OF DISEASES OF THE BREAST.

Treatment of carcinoma—Extirpation of—Circumstances under which the operation ought or ought not to be performed—Fungoid disease of the breast—Symptoms—Progress—Its rapid development—Case—Tendency to hæmorrhage in fungoid disease—Sloughing—Case—Death from bleeding—Identity of scirrhus and fungoid disease; sometimes met with in the same individual Propagation to distant parts—Treatment of soft cancer—Remedies similar to those employed in scirrhus—Soft cancer requires earlier extirpation—Use of the microscope in detecting the medullary effusion—Question as to when the operation is best performed—Case—Operation of extirpation—After treatment, and observances most likely to prevent recurrence of the disease. Cancer in the male—Rarity probably depends on structure—Characteristics of the disease—Identity with cancer in the female—Cases.

TREATMENT OF CARCINOMA.

It will be clearly seen, from what has been already said on the subject, that the use of remedies in this disease could only be available were they capable of changing the peculiar constitutional tendency of the individual; a result which has hitherto, however, proved to be beyond the power of therapeutical science. At the same time it must not be considered that the employment of remedies is altogether useless, for by judicious local and constitutional treatment great benefit may be obtained; the progress of the disease may probably be somewhat staid, and at all events the suffering of the patient mitigated.

In the scirrhous tubercle the principal advantage that can be derived from medical treatment is through the constitution; as the local symptoms being but seldom very urgent, the attention is naturally drawn more particularly to the constitutional deterioration, and the improvement of the health is in such cases the chief object of the practitioner. Should scirrhous tubercle have become developed previously to the cessation of menstruation, uterine disturbance will be almost invariably the prominent symptom, and as the breast sympathizes so closely with the uterus, the indication is to soothe the irritation of that important organ. Even when the scirrhus occurs after menstruation has ceased, it is not uncommon to find the patient complaining of uneasiness in the region of the uterus: if such a symptom manifests itself, an examination should be made to ascertain whether scirrhus has attacked the uterus: if this should be the case, the application of a few leeches, and the use of the ung. potass. iodid. may be found beneficial: the most certain proof of this will be the mitigation of the pain in the mammary tumour. If leucorrhœa be present, either with or without disorganization of the uterus, it must be immediately suppressed by astringent injections, for during its continuance there can be no hope of improving the general health of the patient. Dyspepsia is also a symptom frequently accompanying scirrhous disease, and we can easily understand how slight can be the chance of effecting improvement in the vital energies, when the assimilative powers are themselves defective. Gentian or quassia, with the mineral acids, will be found useful in such cases; or should there already be a tendency to acidity, the iodide of potassium with liquor potassæ will be found an excellent remedy; it may be given either with or without narcotics, according to the suffering experienced by the patient. In the treatment of the mammary tubercle itself, the great point is to keep the arm in a state of perfect rest, and by the application of one or two leeches where the pain is most severe, to subdue at once the effects of any accidental source of irritation: change of air and scene will be found highly conducive to the improvement of the health, particularly change of scene, if there be any cause of mental distress connected with the ordinary domestic duties of the patient; for I have already mentioned how much mental anxiety aggravates the disease, even if it be not sufficient to produce its development in the first instance. The practice of sending patients abroad in this as in other diseases of a hopeless character, is equally cruel and useless: cruel, because the sufferer is removed from every domestic comfort, and more or less separated from the objects to whom she is bound by the strongest ties of affection; and useless, as change of air can only be looked upon as a means of diminishing her suffering, and can never be expected to effect an ultimate cure. Sir Astley Cooper mentions the case of a lady, a patient of Sir David Dundas, who was recommended to make a voyage to Trinidad, under the hope of re-establishing her health: the disease went, however, through all its usual stages, the fatal termination appearing to be in no wise checked by the influence of the voyage.

In another case, a lady went from England to India, under a similar hope of improving her health; but the disease went on, and she only lived long enough to return to her native land. Pregnancy seems to exercise a powerful influence over this disease; and even during lactation, if the mother suckle the child, the tubercle seems to remain quiescent: but after these natural actions have ceased, the virulence of the disorder appears to be increased, and the patient very shortly falls a victim to its renewed attack.

It is a remarkable fact that no case is recorded of scirrhous disease commencing during pregnancy: this serves, I think, to show how effective an improved condition of the constitution must be in checking the advances of the disease; and therefore we may reasonably hope that, at some future period, a method of treatment may be discovered that will be capable of establishing in the constitution artificially a state similar to that which nature induces during uterine gestation. At present, no medicines are known which can effect this; but there can be no doubt that iodine, arsenic, small doses of mercury, and indeed all the alterative remedies, afford relief, although it is only of a temporary character. In my opinion, however, most advantage will be derived from strict attention to the natural secretions, rules of diet, and to maintaining the mind of the patient in a serene and equable state.

When ulceration has commenced, the danger of the disease is much increased, from the liability now established to its propagation to other parts of the system. We know of no remedies competent to the suppression of this action; and although it is generally considered an unfit time for the extirpation of the breast, still I believe that if the axillary glands be not enlarged, there is no reason why the operation may not be performed at this time with as much propriety as before ulceration had taken place—that is to say, if the operation can be looked upon as affording any just hope of success in the treatment of cancer. After all, I fear it can only be regarded as removing the external development of the disease, and not as eradicating the cause, which is, in fact, to be found in the defective constitution of the patient.

If the operation should not be considered advisable, or the patient should refuse to submit to it, considerable benefit may be derived from the application of chloride of zinc to the ulcerated surface, when that is not too extensive. I have often been surprised at the rapid manner in which ulceration has been checked by this treatment: a healthy condition being temporarily induced, and the pain much diminished. I tried this system of treatment, about a year since, upon a patient in Guy's Hospital; and at one time I thought she was becoming perfectly cured: the pain ceased, the scirrhous hardness was removed, and an apparently healthy granulating surface seemed about to close the wound: just, however, at this time, all the specific characters of the disease returned, the glands in the axilla became enlarged, and she died under the usual circumstances of the disease. It would therefore appear, that in treating cancer, the utmost that can be done is to mitigate the symptoms by sedative treatment, instead of fruitlessly attempting the eradication of the disease; and the following pill is the most effectual remedy with which I am acquainted for producing the desired object in these cases:—

℞ Acet. Morph. gr. ij.
Ext. Hyoscy.
Camphoræ,
Ext. Colocynth, co. āā. ℈j. M.
Ft. pil. xiv. quarum capt. j. bis terve quotid.

MEDULLARY SARCOMA OF THE BREAST.

This disease has been differently named by authors. By Hunter it was termed fungous disease; by Sir Astley Cooper, soft cancer; and Mr. Hey, of Leeds, has proposed for it the name fungus hæmatodes: by some it has also been called medullary sarcoma, which term is perhaps appropriate, when the disease has reached the ulcerative stage. The varieties of name have arisen from the particular conditions the disease may have assumed during its development; for it will be found, that the same disease generally termed cancer, is capable of being produced under the form of a hard tumour, or that of a soft medullary exudation, the difference between the two probably arising from the peculiarities of the constitution.

The name which is, in my opinion, the most correct in the usual form of the disease, is that proposed by Sir Astley Cooper —viz., "fungoid, or soft tubercle of the breast."

In this variety of cancerous disease, as well as in scirrhus, any exciting cause of irritation in the breast gives rise to increased action, which in a healthy person, under proper treatment, would terminate by resolution; but under peculiar constitutional deterioration, a new element is eliminated from the blood instead of healthy effusion, and this constitutes a tubercle, which, in young and sanguineous females, is much softer than the deposition in the disease already described as carcinoma. This is, in fact, the adhesive stage of the disease, and is modified according to the peculiar circumstances under which it has been propagated. At first, the tumour will be found very moveable upon the mamma, and perfectly free from adhesion to the skin, softer to the feel than the chronic scirrhous tumour, and possessing very much the physical properties of an enlarged gland in a scrofulous patient: indeed, the resemblance is so strong, that the diagnosis is very difficult, and one can only be distinguished from the other by ascertaining that the patient is generally free from any strumous taint. The tumour in fungoid disease has also but slight disposition to suppurate, being rather inclined to go on increasing greatly in size: it is at first attended with little or no pain, and manipulation does not produce any uneasy sensation; its consistency is tolerably uniform, from the centre to the circumference, although it yields somewhat to pressure, but this is rather from its elasticity than from fluctuation. The fungoid tumour is much less circumscribed than the scirrhous, or even than the scrofulous enlarged gland: so indefinite, indeed, are its limits, that it presents altogether a different sensation to the hand, giving the idea of diffusion,—somewhat, indeed, like that experienced on handling an œdematous swelling. The disease often increases, not merely by the growth of the original tubercle, but from the formation of fresh ones at other parts of the breast: this gives an additional irregularity to the surface; but I have seen in this disease, as in scirrhous inflammation, an almost simultaneous fungoid growth through the whole mass of the breast. I remember seeing a case, in Alfred-place, Bedford-square, with Sir Astley Cooper: it was that of a young lady, thirteen years of age; she had menstruated once, and immediately after, her left breast increased rapidly in size: this much alarmed her aunt, with whom she resided. Sir Astley Cooper was consulted, and I accompanied him to visit the patient. With the exception of its size, the breast presented nothing remarkable in its appearance beyond what might have been expected from the period of life at which the patient had arrived. Still it was evident that some abnormal action existed, as the other mamma had not reached even its natural development under the uterine action. When manipulated, the whole seemed softer than natural, and in some points yielding so as to give somewhat the sensation of fluctuation: there was no pain, even when the breast was pressed with the fingers; but the patient's general appearance indicated a highly cachectic diathesis. Sir Astley Cooper pronounced it to be soft cancer; and as the glands in the axilla were unaffected, he recommended its immediate removal. After a delay of eight or ten days, the friends of the young patient decided on permitting the operation: in the meanwhile the breast had, however, increased to nearly double its former size, so that the operation was rendered much more formidable. For a few days after the operation, the patient seemed to rally from the shock; but within a fortnight, the wound reassumed its malignant character: large fungoid masses sprouted from its surface, and six weeks after the operation she died. Upon examination of the body, fungoid tubercles were found in the liver, lungs, and mesenteric glands. A section of the tumour showed large masses of medullary matter enclosed in cysts, with interstices between them, through which large bloodvessels took their course: the tumour presented, in fact, very much the appearance of a mass of brain surrounded by a covering of injected pia mater.

As I have already observed, at the age of puberty it is not uncommon for one breast to become much more rapidly developed than the other, and this rapid growth may lead to so much congestion of the superficial veins as to impart to the breast the appearance of malignant disease: this fear is soon, however, removed from the mind by the breast on the other side attaining an equal size; there would also in such a case be a total absence of constitutional deterioration.

If a carcinoma medullare be allowed to proceed in its course without extirpation, it will shortly pass into a condition closely resembling suppuration, the tubercles then become so soft in the centre as to communicate a sensation to the touch similar to that in abscess: it is, however, unattended by any constitutional symptoms indicative of the formation of pus. If an opening be made in these tumours, sometimes blood only will be discharged; at other times the effused matter will consist of serum, coloured by red particles, or of a thick grumous fluid; and this variation shows that the fluid effusions are as much modified by the peculiar state of the constitution as the solid parts of the morbid growth. After being punctured, the incised edges sometimes grow together again immediately, and fresh accumulations of fluid take place; but it more frequently happens that unhealthy fungoid granulations sprout out of the opening, and the wound never afterwards heals: this is so often the result of puncture, that I consider it a bad plan to explore a fungoid tumour, for the disease goes on increasing much more rapidly after the granulating process is established. If a fungoid tumour be not surgically interfered with, it quickly passes spontaneously into the ulcerative or sloughing stage; there are, however, certain pathognomonic symptoms indicative of the change. The skin alters in colour, becoming of a dingy bluish tint; it also becomes tense, and the patient now, for the first time, experiences pain in the part, and begins to attach importance to the disease: in the course of a few days the ulceration commences, and a fluid secretion is evacuated, sometimes possessing a very fœtid odour. In a short time the discharge ceases, and the fungoid growth protrudes through the ulcerated opening, presenting an irregular cauliflower surface of unhealthy granulations. The granulated surface has a great tendency to bleed, breaks down under the slightest touch, and often requires the application of styptics to check the hæmorrhage. When the granulations have become very exuberant, and the malignant excrescence has acquired a very large size, it loses its vitality, and begins to slough: this action sometimes goes on to so great an extent as to lead to the short-lived hope that the whole disease would be thus thrown off; but the malignant action, I believe, invariably returns. I remember a case of this kind which occurred many years ago under Sir Astley Cooper and myself: the subject was Dr. Tate, a physician in the navy, who was living at Pimlico; he had an ulcerating fungoid disease of the cervical glands: the tumour was most prominent just above the clavicle. After the tumour in this case had acquired a very great size, gangrene supervened, and the whole morbid mass sloughed away, leaving the granulating surface of a healthy appearance; indeed, at one period Sir Astley Cooper entertained hope that the disease was only local, and that there was a possibility of the patient's recovering. Suddenly, however, the diseased action recommenced, fresh excrescences were formed, a kind of phagedænic ulceration followed, and a very short time after the subclavian artery gave way, and the patient bled to death. This case shows that hæmorrhage may be the sequel to this disease, and it also teaches us that lymphatic as well as secreting glands may be primarily affected with fungus or soft cancer. Bleeding is, indeed, frequently the cause of death in fungoid disease, if not by the bursting of a large artery, by repeated bleeding from small ones; indeed, even the sanious effusions from an extensive granulating surface may be sufficient to ultimately destroy the life of the patient.

During the progress of this disease through the adhesive, suppurative, ulcerative, and even to the gangrenous stage, the constitution sometimes remains almost unaffected, and the patient is free from pain or any symptom beyond that of debility; proving in how slight a degree constitutional symptoms are commensurate with the importance of the disease: indeed, unless some vital organ be affected, the only symptoms may be the debility and anæmia occasioned by the profuseness of the effusions.

When dissected, these soft cancerous tubercles seem to present very different appearances to the cursory observer; but upon minute dissection they are all found to be composed of a cystiform mass: the cysts themselves contain, however, different products, according to the peculiarities of the constitution and the age of the patient, and somewhat, I believe, according to the nature of the tissue originally or subsequently involved. The variety in these effusions can scarcely be a matter of surprise, when even in common inflammation we find the products, under certain circumstances, varying as much as in malignant disease; not having, however, the same tendency to indefinite increase, although, perhaps, being unfitted to become organized and converted into healthy structure. Thus, in persons of a strumous diathesis, we find non-plastic caseous matter deposited under the adhesive, and ill-formed pus-globules under the suppurative inflammation; but this tendency may be improved by judicious remedies, while, on the contrary, in the malignant cachexia, we can do but little for the relief of a patient, and nothing for the cure. At the same time, it would be very difficult to form a diagnosis between a bad strumous and a malignant deterioration: not that I mean to argue that these conditions are identical, but to point out that the line of demarcation is very indistinct, and that they seem to approach each other by imperceptible gradations. The effused matter contained in the cysts or cells will be found of a consistence and nature somewhat resembling the structure whence the disease originates: for example, when it arises from the fibrous tissues (a common seat of this disease) the effused matter will be found to present a kind of fibrous arrangement, its cells being prolonged somewhat in the same manner as in ordinary hypertrophy; but the new growth never acquires the physical properties of fibrous tissue, nor is it able to sustain its own vitality,—fibrin, serum, and grumous effusions may all form the contents of these cysts; sometimes in the same patient, in different parts of the same tumour, according as the patient's health has varied during the progress of the disease; and I am convinced that I have seen in the same individual both the fungoid and the hard scirrhous tubercle. The presence of scirrhus and soft cancer in one individual proves to me that the diathesis is the same in both these diseases; indeed, it not unfrequently happens that after the extirpation of a hard, well-defined scirrhous tubercle, the wound will not heal, but a cauliflower, fungoid excrescence, will be thrown out, and the patient ultimately die with all the indications of soft cancer. It generally happens that the patient, when the subject of soft cancer, dies in consequence of the propagation of the disease to a vital organ, and not from its primary development, and all the structures of the animal frame are liable to become thus secondarily affected. The lungs are particularly disposed to contamination, especially if there be any tendency to phthisis, and fungoid tubercles are frequently found both superficially and deeply seated in their substance. This produces a defect in respiration, readily detected by auscultation: the liver is also liable to undergo malignant deterioration, and from the yellowness of the complexion in the subjects of this disease, one would be inclined to think that the functions of the liver become early disordered, even before the disease has become manifest in the organ. The spleen, kidnies, ovaria, and uterus, have all been found infected. Sir Astley Cooper mentions a case in which there was fungoid tubercle in the substance of the right ventricle of the heart; and in the museum at Guy's Hospital there is a preparation of the aorta, in which that vessel is nearly obliterated by a malignant tubercle. The eye is not unfrequently extirpated for this disease, and fungoid matter has also been found in the thoracic duct. This would seem to prove that the elements of the affection are capable of being taken up by the absorbents; for we can scarcely suppose that the cells could themselves generate the disease in this situation. Fungoid disease is sometimes congenital, and there are in Guy's Hospital Museum, both preparations and models, showing the full development of this disease in infancy; presenting, perhaps, one of the strongest possible evidences of the truth of the doctrines of humoral pathology.

Treatment of soft cancer.—Medicine does not appear to possess any power over this disease, when once it is established,—even extirpation is unavailing. I am, however, of opinion, that as the operation removes a great source of constitutional irritation, it ought not to be entirely repudiated, and the patients abandoned to their fate. Alteratives are the class of medicines employed in this disorder, and are the same as those mentioned in scirrhus. In those cases of fungoid tubercles which appear to arise rather from deterioration of the part than from general cachexia, I should apply the chloride of zinc, to destroy, if possible, the local action: such an application should, however, only be made in the earliest stages of the disease; and at the same time it would be desirable that tonic alterative remedies should be administered for the improvement of the general health. Soft cancer requires earlier extirpation than any other form of malignant disease, for the medullary effusion is the most rapidly absorbed; and Mr. Quekett, who is one of the best microscopists of the day, has detected this peculiar matter, not only in the absorbents, but also in the blood. A question thus arises as to whether the malignant corpuscle is originally formed in the blood, or whether it is taken up after it has been developed in the solid tissues; the latter seems to be the case, as these corpuscles have only, I believe, been found in venous blood, It is a subject of great importance to ascertain what period is best for the performance of the operation in cancer. There can, in my opinion, be no doubt that when once the disease is considered to be malignant, its extirpation cannot be too soon effected, as the enlargement of the axillary glands, the adhesion of the malignant tumour to the skin or subjacent tissues, or the commencement of ulceration, all tend to diminish the probability of recovery. It does not, however (as I have before said), follow as a certain rule, that when the axillary glands are enlarged, it must be from propagation of the disease, as the increase of size may have proceeded from irritation alone: the surgeon may generally judge by the physical condition of these swellings, whether they proceed from malignant contamination, or from common inflammation: if we believe the latter to be the case, the operation may be performed, or even if one isolated gland be diseased that may be removed at the same time as the breast. I have had several cases in which the tumour adhered both to the skin and pectoral muscle beneath. In these I extirpated the disease, not with the hope of effecting permanent cure, but from a desire to alleviate the acute sufferings of the patient. In all these cases the disease rapidly returned, but I attained the object I chiefly had in view—the diminution of the continued excessive suffering. I have in some cases even been induced to remove the breast, when in a state of ulceration, where the pain was very severe, and the discharge so profuse as to drain the constitutional powers, and also aggravate the suffering by its excoriating influence on the skin. I remember a patient being in the hospital with an ulcerated scirrhous breast, of immense size; the discharge was so great that the dressings and bed-linen were constantly wet, and there was great excoriation of the skin. In this case I proposed the extirpation of the disease, not with any hope of effecting a cure, but with the intention of improving the condition of the patient by diminishing the pain and inconvenience arising from the amount of effusion. The operation was performed, and the result far exceeded my expectations: the poor woman slept well from the first night; her general health improved; the wound for some weeks appeared to be under a healthy action, and she seemed infinitely relieved in every respect by the operation. Suddenly, however, fungoid growths were thrown out from the granulating surface: her health again gave way, but there was neither pain nor discharge as before; but she shortly sank from complete constitutional exhaustion. Upon post-mortem examination it was found that almost every organ was more or less contaminated by the fungoid disease.

Operation for the extirpation of the mamma.—The sitting position is the best in which the patient can be placed for this operation; but where chloroform is used, as is now much the practice, the operation must be performed with the patient in the recumbent posture; there is no objection to the latter if the tumour be large, but if it be a small one it is much more easily reached when the patient is sitting. Whichever position be chosen, the arm must be abducted and held back by an assistant; as this position of the limb not only tends to put the skin on the stretch, but to facilitate its dissection from the pectoral muscle. The diseased portion of the breast must be removed by two curved incisions, the extremities of which meet, the diseased part being included between them. The lower incision should be first made, as the blood will not then interfere with the further steps of the operation. This incision should commence sufficiently on the outer side, and be continued far enough towards the mesian line, to include the whole of the disease. At the same time it must be carried to a depth that will admit of the exposure of the fibres of the pectoralis muscle, from which the lower part of the tumour must be raised. The upper incision is made to commence at one extremity of the lower cut, and being carried above the tumour in a curved direction, joins it again at the other end; the extent of space comprised between the two incisions will, of course, depend upon the size of the tumour, but must in every case be sufficient to insure the removal of the whole of the contaminated structure. The bloodvessels unavoidably divided in these incisions ought not to be tied at the moment, but the hæmorrhage restrained by the pressure from the finger of an assistant, until the removal of the breast or tumour be completed, after which they should be permanently secured by ligature.

Before the wound is dressed, the surgeon should make a most rigorous search to ascertain if any portion of the diseased structure be left,—even to an abnormal change in the condition of the cellular membrane; for if any of the morbid matter remain, it would induce a very great liability to the rapid return of the disease. When the surgeon is satisfied that the whole of the contaminated parts are removed, the edges of the wound should be brought together, and a piece of lint dipped in cold water laid upon the surface, and allowed to remain there during three or four hours, until, indeed, the danger of secondary hæmorrhage is past. The wound should not be dressed before this, as nothing is more distressing to the patient, or interferes more with the reparative process, than the removal of the dressings in consequence of secondary bleeding. In the performance of the operation, when the whole mamma is not involved in the disease, and when the nipple is not retracted, it is a matter for consideration whether the whole breast ought to be removed, or the tumour only dissected out with that portion of the gland affected. In my opinion, when the disease is of a truly malignant character, the whole of the breast ought to be extirpated; but if the effusion be not malignant, the extirpation of the tumour itself will be sufficient. Should an isolated gland in the axilla have become enlarged, and any doubt exist as to its malignant character, I think that it should be removed without hesitation, although many surgeons consider that the secondary development of the malignant growth is in itself sufficient to preclude the propriety of resorting to the operation at all. For several months after the operation, the patient should keep the arm on the diseased side at rest, so as to avoid stretching the cicatrix, as irritation from any source would produce a disposition to the return of the disease. Constitutional remedies, change of air, and freedom from mental emotion, are the most likely means to preserve the patient from its recurrence.

DISEASES OF THE BREAST IN THE MALE.

Cancer in the mamma of the male is very rare, and this is equally true of all the other diseases of the breast, which in the female are unfortunately of common occurrence. This fact depends, no doubt, upon the difference of the anatomical structure of the mammary organ in the male and female; no glandular structure, properly speaking, existing in the male, the nipple and areolar, with some hair and fat follicles, being alone developed. Sir Astley Cooper has, however, stated that the lactiferous tubes exist in a rudimentary state, and may be injected. Although the male and female breast differ thus in their anatomical character, cases are recorded in which the male has become the subject of most of those breast diseases which do not depend upon the interruption of any peculiar sexual function; and cysts containing fluid, encysted tumours, and in one case a deposit of calcareous matter, have been found developed in the breast of the male. A hypertrophied condition of the male breast is also sometimes met with: in these cases the breast assumes an appearance similar to that of the female in its usual state; and it is said that milk may be secreted under such circumstances.

I have myself sometimes witnessed in the male, during the period of puberty, changes occurring in the mammæ which resemble very closely those which take place in the female at the same period of life. On one occasion, upon casually entering a shop, I heard a youth requesting a shopman to furnish him with a pair of braces constructed so as not to press upon the nipple. The earnestness and delicacy of his manner excited my professional curiosity; and, in the hope of being able to assist him in obtaining that which he required, I asked him to allow me to examine the source of his uneasiness. I found the right mamma much enlarged, the nipple red and prominent, and the whole region bearing a strong resemblance to the irritable breast of a young female: a fluid like a mixture of milk and pus could be pressed from the nipple. Poultices, fomentations, tonics, and the scrupulous removal of every external source of irritation, soon relieved all the symptoms; but the patient has remained subject to their recurrence if the part became in any way irritated. It is worthy of remark, that his brother is also liable to the same abnormal condition under similar circumstances.

Carcinomatous growths are much less frequent in the breast of the male than in that of the female: they sometimes, however, attack the male mammary organ, both under the form of scirrhus and soft cancer: the scirrhus is more frequent than the medullary form, and the disease is much less rapid in its progress in the male than in the female breast; it usually exists, indeed, for many years before the symptoms become urgent: at the same time it should be remarked, that there is not an equal tendency to reappear after extirpation. When these tumours have been examined after their removal, they have been found similar in every respect to the scirrhous tumour in the female; and, from all the circumstances attendant upon the development of the disease, as well as from its physical organic structure, its identity in the male and female appears to be completely proved. Although it is said that the male breast is without the glandular structure found in that of the female, I believe the statement to be incorrect. It is true, the glands seldom become developed; but there can be, I think, no doubt that the rudiments always exist; and, where an hypertrophied state of the male mamma is found, it depends only upon the development of those tissues which, in a latent state (if I may employ such an expression), are always present.

In proof of this view, there are many cases recorded in which the mamma in the male has become developed, and even secreted a fluid, in consequence of the stimulus produced by the sucking of an infant which had been placed at the breast of the father merely for the purpose of quieting it during the absence of the mother. A well-authenticated case of this kind is related by Sir Astley

Cooper, in his work on the Breast, as described to him by his nephew, Dr. Young, of Barbadoes. The atrophied breast of old women is also said to have been excited into a secondary action by the stimulus imparted by a child's sucking. Now, as secretion implies the existence of glandular structure, however simple that structure may be, I think that the fact of a fluid similar to milk having been produced under stimulus in the male, and the identity of scirrhous disease of the breast in the male and female, furnish sufficient proof that a rudimentary glandular structure exists in the male. There are two preparations of male mammæ, removed by myself, in the museum of Guy's Hospital, showing the physical identity of these abnormal conditions.

The following cases will show the character and progress of the disease, and the points in which it appears to differ chiefly from cancer in the female:—

A man, aged thirty, was admitted into Guy's Hospital, with a tumour in the right mammary region. He was unmarried, and of delicate and somewhat feminine appearance and manner. Five years before coming into the hospital, he had received a blow upon the right nipple: a few months after, he discovered a small tumour, about the size of a marble, on the spot: the tumour was soft, not painful on pressure, and on two or three occasions he forced out of the nipple a small quantity of a white fluid somewhat thicker than milk. The tumour gradually became larger, but continued soft, until about two years prior to his coming into the hospital, when he suddenly perceived that it had become hard and firm to the touch.

Since this time he had frequently received blows on the part, and the tumour had gone on gradually increasing in size, with frequent "shooting and darting pains." Five months before his admission, two nipple-like prominences formed, and the skin over them became discoloured, as if about to ulcerate. When he was admitted into the hospital, the tumour was as large as a small apple, and was hard and irregular. The day after his admission I extirpated the part: the patient manifested great want of fortitude under the operation.

After its removal, the tumour was examined: it had all the appearance and feel of true scirrhus, the nucleus consisting of cartilaginous and fibrous matter, disposed in radii, and being surrounded by condensed cellular membrane. This case is well worthy close attention: the patient was afflicted with a disorder rare among men; but he, in addition to his having a womanly disease, had also a womanly aspect and a womanly spirit.

Mr. Birkett has informed me, that in 1837 he met with a case of carcinoma in the breast of a man: the patient was forty-four years of age, of an unhealthy aspect, and suffering from indifferent health generally. The tumour, in slight degree, had existed for nine years. Four months before he was seen by Mr. Birkett, he had received a blow on the left nipple. Since that time the tumour had gone on increasing with rapidity: it was firm, circumscribed, hard, but not stony, and the skin around was but slightly implicated in the disease. The tumour was removed by the late Mr. Callaway: the wound healed very readily; and fourteen months after the operation, there was no indication of the return of the disease.

Mr. Birkett adds, that he examined the growth after its removal, and, from its appearance and general character, did not doubt but that it was true carcinoma.

LECTURE LVII.

DISEASES AND INJURIES OF THE VASCULAR SYSTEM.

The vascular system—Arteries—Veins—Lymphatics—Organization of arteries—Functions of the arterial coats—Diseases of arteries—Inflammation, diagnosis, treatment, and post-mortem appearance—Chronic inflammation of arteries—Its usual effect—Produces either atheromatous or bony deposits — Ossification of arteries in old people.

Aneurism by anastomosis—Causes of the disease—Sometimes congenital, as nævi—Treatment, by topical applications, by pressure, injection, &c.—Cases—Operation for the cure of nævus.

Dilatation of arteries—How produced—Direction of the dilatation —Diagnosis—Treatment.

Aneurism divided into spurious and true—Spurious aneurism—How produced—Cases.

The vascular system in man is composed of three different classes of vessels — the arteries, veins, and lymphatics: these constitute the means of conveying nutrient matter to the different parts of the body. The vessels through which the fluids circulate must not, however, be regarded as mere inorganic hydraulic tubes; they possess an organization as perfect as that of any other tissue, and are themselves furnished with a system of vessels termed the vasa vasorum, the function of which is to supply them with the blood required to preserve them in a state of health. The arteries constitute the most important of the vessels of the animal body, as they convey throughout its different structures the fluid from which those structures are all immediately elaborated, and on a due supply of which they depend for the preservation of their normal condition. The arteries are derived from two main trunks, but they divide into innumerable branches, and ramify to terminate in the capillaries of every tissue.

The capillaries are endued with the power of appropriating the blood conveyed by the arteries to the use of the various tissues; but the whole of the blood is not thus appropriated by the capillaries, and the superfluous quantity is received by another set of vessels termed veins; by these it is re-conveyed to the heart, and in its refluent course receives the chyle (produced by the process of digestion) through the medium of the thoracic duct. The veins commence from the capillaries in an infinite number of minute branches, and terminate by two large trunks in the left side of the heart.

The absorbents are divided into two classes—those which convey the chyle into the veins, and which are termed the lacteals; and others, called the lymphatics, which absorb the debris of the exhausted tissues, and other extraneous matters introduced into the body. The lymphatics take their course in close contiguity to the veins, and by a process termed endosmosis and exosmosis an interchange of the contents of these different classes of vessels is continually going forward. Many physiologists have supposed that the veins possess the power of themselves absorbing disintegrated tissue; but it seems to me that the reciprocal action between the lymphatics and veins explains the phenomena of absorption in a much more satisfactory manner.

Organization of arteries.—It would be unadvisable to commence with the diseases to which the arteries are obnoxious, without briefly considering the character of the tissues which enter into the composition of these vessels, and the function for which each of these tissues is intended.

The arteries are composed of three coats, connected with each other by a distinct layer of delicate cellular tissue, furnished with its peculiar system of capillaries (vasa vasorum), to convey to each coat such nourishment as fits it for the performance of its specific office in the animal economy.

The first of the arterial coats is termed "the external or elastic coat:" this seems to be formed by a condensation of the surrounding areolar tissue, strengthened in some situations, if not in great measure produced, by the splitting of the facial covering of the region, as in the neck and extremities; some of the "yellow elastic tissue" may, however, be detected, blended with the reticular fibres. The external coat constitutes the principal source of strength in an artery, especially in the longitudinal direction: its elasticity at the same time permitting of all the various motions and tension to which the vessel is exposed in the different positions of the body. When, therefore, any action arises in the capillaries of the external coat, rendering them incapable of eliminating from the blood the elements essential to maintain the normal physical conditions of the tunic, the integrity of the vessel is disturbed, and some form of disease becomes established in it.

The "middle," or, as it is often called, the "muscular coat of the artery," is composed of transverse fasciculi of fibres, closely resembling in arrangement the involuntary muscular fibres of the intestines. They differ from the latter, however, in colour, and in their want of contractile power. The fibrous membrane of which the second coat is composed, seems to consist of fibres of "yellow elastic tissue," united by condensed cellular membrane; and it is by the physical elasticity of this structure, and not by possessing any vital power of contraction, that the middle coat of an artery assists in the circulation of the blood.

The third coat is called the internal or serous coat. This must be regarded as the most important of the three: it is said to extend continuously throughout the whole of the vascular system, and is peculiar from its forming the semilunar folds, or valves, at the commencement of the two primary arterial trunks. The internal coat is a thin white diaphanous membrane, consisting of a distinct arrangement of fibres, which, under the microscope, may be seen intricately intersecting each other, so as to form a dense resisting and elastic membrane, resembling in appearance serous membrane. Like them it is also constantly moistened by a serous secretion eliminated from the blood by the capillaries. Under inflammation, the third arterial coat is very liable to throw out adhesive or plastic effusions. The flow of the blood through the arteries is greatly facilitated by the extreme smoothness of this lining coat.

If an artery be much stretched, or tightly compressed by ligature, its internal and middle coats give way; but the external coat, from its superior elasticity, may recover its normal condition. A knowledge of this circumstance, and of the tendency in the internal coat to undergo the adhesive inflammation, led John Hunter to the bold experiment of applying a ligature around a living artery on the proximal side of an aneurism, so as permanently to stop the supply of blood to a tumour. The internal coat of an artery seems to possess some vital power which tends to maintain the fluidity of the blood: for if there be any defect in the capillaries of that tissue, so that its necessary amount of nutriment be not supplied, or if there be any deposit on its surface, or if the tunic, from any circumstance, should have given way, a small coagulum of blood will be formed at the spot where the deterioration has occurred; and I believe such an action to be almost always antecedent to the formation of aneurism. If any deduction can be drawn from experiments upon the lower animals, I should judge that aneurism, as a disease, invariably commences in deterioration of the internal coat of the artery; for, in a series of experiments which I instituted on this subject, I found that I could not by any means, applied externally to the artery of a dog, produce an abnormal dilatation—every experiment failed, in consequence of the healthy internal coat immediately sealing up the vessel by plastic deposition.

DISEASES OF ARTERIES.

Acute inflammation.—The arteries being supplied with blood by capillaries, in a similar manner to the other tissues of the body, are equally liable to take on an inflammatory action : this may terminate either in resolution, adhesion, suppuration, ulceration, or, more rarely, mortification.

The symptoms of inflammation in an artery must always be very difficult to appreciate when they arise from a constitutional cause; but when they follow the application of a ligature, the extension of pain in the constricted vessel naturally leads to the inference that inflammation of the artery has set in. But even here the diagnosis is liable to be incorrect, as the pain may be occasioned by a filament of a nerve being included in the ligature. In that case, however, the peculiar pain or numbness, and its extension in the course of the distribution of the nerve, would probably lead to the formation of an accurate judgment. The implication of a vein may also be a source of considerable difficulty; but as the treatment would be the same, whether artery or vein were the subject of inflammation, the necessity for an exact diagnosis is less important. If, after lesion of an artery or the application of a ligature, symptoms of inflammation manifest themselves, under the form of pain along the course of the vessel, increased action in the part supplied by its branches, and the constitutional effects usually concomitant with inflammation, antiphlogistic remedies must be employed; and small doses of tartarized antimony and opium will be found very useful, as a means of lessening the action of the heart, and the quantity of blood sent to the diseased vessel. If the patient be of a pale and sanguineous habit, blood may be abstracted; for it is very important that the inflammation should be subdued in its earliest stage, so as to terminate by resolution, or adhesion, as either of the other results of inflammation might extend so as to render the vessel totally incompetent to carry on the circulation. Depletion must not, however, be carried too far, as the action of the heart would then be increased, although its power may be diminished. Where amputation or the application of a ligature for aneurism has proved unsuccessful, and the case has terminated fatally, opportunities have been obtained of examining the state of the artery which had suffered the lesion; under such circumstances, the internal coat of the vessel has been found to be of a vivid red colour, and manifesting all the usual signs of acute inflammation. This appearance can, however, scarcely be appreciated in the small extent of surface affected, without the aid of a microscope; and it must not be mistaken for the redness frequently seen in the inner coat of an artery after death, and which is produced by the deposition of the red corpuscles of the blood; in the latter case, the stain is only superficial, and may easily be wiped off; while in inflammation the redness is permanent, resulting from a turgescent condition of the capillaries of the lining membrane, and, indeed, even extends to the middle or muscular coat of the artery.

When adhesive inflammation is induced by an injury to an artery, obliteration of the vessel soon follows, in consequence of the tendency in the internal coat to deposit coagulable albumen (fibrin): this result is indicated by the loss of pulsation in the lower part of the trunk, and by the enlargement of the collateral branches, which enables them to perform the office of the original vessel: but as there can be no doubt that this arrangement interferes to some extent with the nutrition of the tissues thus abnormally supplied with blood, every effort should be made, in cases of idiopathic inflammation, to restore the integrity of the injured artery, by inducing resolution as the means of reparation.

In cases of diffused abscess of the cellular membrane, the nutrition of an artery is sometimes so much interrupted as to produce disintegration and absorption of a portion of its coats; this is termed ulceration: it may likewise occur from extension of a phagedænic ulcer to the coats of the vessels; in either case hæmorrhage would be the result; and it is therefore proper, when a chronic abscess is seated in the neighbourhood of a large artery, to be cautious in the examination before the fluid is evacuated, for a diffused aneurism may exist, in which the pulsation had been lost in consequence of the general diffusion of the blood from the loss of the surrounding cellular membrane. Owing, however, to their great tendency to deposit adhesive matter, arteries generally become early obliterated after injury, so that bleeding in consequence of ulceration is of very rare occurrence. Hæmorrhage from sphacelus of an artery is also very unusual; for the coagulum of blood formed in the gangrenous part of the vessel extends upwards into the healthy portion, the capillaries of which becoming excited by the presence of the clot, throw out adhesive matter, and the vessel becomes obliterated up to the first large branch, and hæmorrhage, even in cases of extreme sloughing, is thus effectually prevented. Sometimes, however, the constitutional powers of a patient are so much reduced as to be incapable of maintaining the adhesive action: under these circumstances hæmorrhages occur; but such a termination is extremely uncommon.

In gun-shot wounds we have often instances of coagulation taking place to a remarkable extent, and it sometimes happens that where, in such accidents, amputation is delayed, in consequence of collapse or any other circumstance, the application of ligatures to the vessels is rendered totally unnecessary.

Chronic inflammation of the arteries.—This is a morbid condition which can scarcely be discovered during life; but the changes that are so frequently met with in post-mortem examinations prove beyond doubt that the arteries are subject to subacute inflammation. Thickening of the coats is one of the most common effects of the above action; the consequence is a diminution in their elasticity, a change that no doubt often leads to the rupture of the inner coat, and is probably the most frequent cause of aneurism.

A thickening of the valves of the aorta, in all probability proceeding from chronic inflammation, is often met with; they are sometimes transformed into a kind of cartilaginous tissue, and thus become completely unfitted for their original important office. This thickening sometimes goes on to such an extent as to give rise to excrescences, which Corvisart terms "vegetations."

Chronic inflammation may produce atheromatous deposits between the internal and middle coats of an artery, and these may project into the canal so as materially to interfere with the flow of blood through the vessel. It has lately been proved, by the microscope and by chemical analysis, that these morbid growths consist of fatty matter, and therefore steatomatous deposit would perhaps be an appropriate term for the disease. The obstruction offered in this disease to the circulation of the blood often produces distention of the vessel above the deposit, and in some cases becomes an exciting cause of aneurism. These deposits are not by any means uncommon; but the diagnosis of the complaint during life is very difficult, unless it be situated where auscultation can be employed in the investigation, as in the aorta: in that case a bruit would be present, from which the true cause of the obstruction could generally be conjectured.

Bony deposits frequently result from chronic inflammation; and, indeed, this deterioration is so common in the arteries of old people that it must be regarded, properly speaking, as a change incidental to senescence, and not as disease. The cause of this action is probably to be traced to a diminution in the power of the capillaries of the bones to eliminate phosphate of lime from the blood; an undue quantity of that earthy matter being therefore carried into the circulation, it is deposited in the more vital parts of the system. Under certain diseased conditions, young persons are liable to the formation of these deposits of bone-earth in the arteries, or ossification of arteries, as it is termed.

A frequent result of ossification of the arteries, especially when it occurs in the lower extremities, is gangrene of the limb, in consequence of the imperfect nutrition which the rigid arteries are capable of supplying to parts distant from the heart. Ossified arteries are liable to disruption; the vessels of the brain sometimes give way under these circumstances, inducing coma, to which I think the term "senile apoplexy" may be aptly applied.

The presence of ossification of the arteries may be diagnosed, particularly in old people, by the irregularity of the circulation, and, when the arteries of the extremities are affected, by the tangible rigidity of the diseased vessel. Ossification of the coronary arteries of the heart produces a train of symptoms which constitutes the well-known disease termed "angina pectoris." Gouty and rheumatic diatheses seem to be especially liable to morbid depositions in the arteries; it is therefore highly important, in acute attacks of rheumatism or gout, to entirely subdue the specific action as early as possible, so as to prevent it from passing into the chronic form, under which there is always considerable tendency to the various depositions I have described, all of which are more or less likely to produce aneurism.

Aneurism by anastomosis.—This disease is produced by an unnatural distention of the arteries in any part of the surface of the body: it may either be the result of external injury, or may exist in consequence of a peculiar congenital conformation. I have never in my own practice known a case of this disease arising from an accidental cause, although I have witnessed its development during the period of adolescence without the patient being at all conscious of any congenital predisposition to it. The disease is seated in the vessels of the subcutaneous cellular tissue, and they appear to be in a state of extreme congestion, as if an attenuated or atonic state of their coats rendered them incapable of contracting upon their contents, and consequently unable to carry on the normal circulation: the collateral branches consequently become enlarged and similarly distended, and so, by involving the surrounding vessels, the disease goes on gradually increasing; the veins of the affected structure at the same time undergoing a change analogous to that produced in its arteries. The tumours formed by this disease are easily emptied of their blood by very slight pressure; but as soon as the force is removed they rapidly fill again; not however in the same way as a true aneurismal sac refills after the blood has been pressed from it, but in a gentle, gradual manner, like the imbibition of water by a sponge. These tumours frequently pulsate, but it is rather a species of vibration communicated to them from the surrounding healthy arteries, than pulsation existing in those which constitute the tumour itself. Owing to the readiness with which the blood is pressed out of it, the swelling is very compressible, the skin becoming much paler; as soon, however, as the blood is allowed to return, the abnormal red or bluish tinge of the tumour is resumed. When handled, these swellings give the idea of a spongy or doughy structure intersected by permeable canals, and feel, under the hand, like a portion of distended spleen.

Although the skin covering these abnormal erectile tumours sometimes experiences but little change in colour, at others it appears of every variety of tint, from a mere blush to a dark mulberry colour; in most cases, excitement of any kind induces a temporary deepening of the colour, and in a fit of passion or coughing the swelling becomes inordinately distended, and has in some cases been known to burst and give rise to a dangerous hæmorrhage. In females, at the age of puberty, periodical bleedings sometimes occur from these tumours, as from menstrual ulcers; under such circumstances no measures for the removal of the tumour ought to be taken until a healthy uterine action has been effected, by the administration of appropriate constitutional remedies.

When these tumours are congenital, they are generally termed nævi-materni: they evidently result from arrest of nutrition in the coats of the affected arteries, and therefore the disease may be said to originate in the vasa vasorum, and not in the arteries themselves. Indeed, even when the disease commences subsequently to birth, it without doubt depends upon a defective condition of the coats of the arteries, and not upon an excessive action in the vessels; the disease must consequently be regarded as one of a local atonic character.

If this affection be produced, as it sometimes is said to be, by external violence, the vessels of the injured tissue become distended by the abnormal quantity of blood sent to the part, and which exceeds the amount of fluid which the vessels are capable of propelling; hence permanent congestion results, constituting the disease now under our consideration; but I cannot bring myself to believe that such an effect could be produced by external injury upon originally healthy vessels, unless by altering the action of the capillaries themselves. These tumours should be, at the earliest possible period, subjected to proper surgical treatment, as the danger and difficulty of cure are increased in proportion to the size they are permitted to attain. This affection is usually congenital, occurring as nævus; and may be at first so superficial and small in size, and differ so slightly from the surrounding parts in colour, as to scarcely possess the physical characteristics of aneurism by anastomosis; it seems to be, indeed, a mere hypertrophy of the rete mucosum, being usually situated in the integument of the face, neck, or some other highly vascular part. These spots sometimes disappear spontaneously; and if but small, and not much raised above the skin, I have known them removed by merely keeping the surface constantly wetted with a strong solution of alum. If this remedy prove effectual, it will be known by the nævus becoming hard and colourless, as if its blood had become coagulated: nitric acid is also sometimes employed, but it produces a slough, upon the separation of which there is great liability to hæmorrhage; and as children but ill bear the loss of blood, I do not consider the use of this powerful agent safe. Pressure upon the cellular tissue surrounding the nævus is sometimes resorted to, the intention being to cut off the supply of blood to the part. The best way of effecting this is, to make a plaster of Paris cast of the tumour, and when this has become hard, to bind it upon the part with sufficient force to prevent its receiving nourishment from the surrounding vessels; as the size of the tumour decreases, thin layers of lint must be placed in the plaster mould, to enable the pressure to be kept up: but this plan of treatment can only be adopted when the swelling is situated over bone, as in the scalp. Many years ago, I remember a case being thus successfully treated by Mr. Hodgson, of Birmingham, who then lived in London. I have twice adopted this plan, but without success, and was obliged to proceed to other treatment. Injections into the erectile tissue are sometimes employed: weak solutions of iodine, corrosive sublimate, and alum, have all been used, and with success. I have myself several times injected nævi with a saturated solution of alum, as in the following case:—

A child of a poor woman, about six months old, was brought to me with a nævus near the ala of the nose, extending to the corner of the mouth: it was prominent, compressible, and the skin of a strawberry-red colour; the growth of the tumour had been very rapid. I procured a "lachrymal duct syringe," and making a very small opening in the healthy skin, close to the edge of the tumour, injected half a drachm of the solution of alum into the erectile tissue: the colour of the skin was immediately changed to blue or slate colour. I desired the surface to be kept constantly moist with a solution similar to the one I injected, and the disease was soon entirely removed, without a single bad symptom. Mr. Longmore, junior, of the Borough-road, sent me a case of a nævus, in the side of the cheek, which I inoculated with vaccine matter—a plan which has been said to prove effectual in curing the disease: the treatment was, however, unsuccessful in this case; and I injected the tumour with alum and treated it as in the case described above, with complete success. In several other cases I followed the same plan, with the happiest results: in all these, with one exception, the nævi were on the head and face, and that was in the arm. After this series of successful cases, I was consulted by the wife of a clergyman in Suffolk, whose child had a large nævus on the inner side of the thigh: the tumour was very compressible, and communicated more than the usual thrilling sensation to the fingers as the blood was circulating through the tissüe. With the confidence inspired by my former success, I proceeded to inject the tumour with a solution of alum, as before described, but employed a larger syringe, in consequence of the greater size of the tumour. The child did not at the time appear to suffer more than is usual in such cases, but towards the evening of the day of the operation I was sent for, in consequence of its excessive uneasiness. I found it suffering under a high degree of irritative fever; the thigh was much swollen and inflamed. I immediately ordered a dose of calomel and antimony, and applied fomentations to the limb; but for three or four days the child remained in the most imminent danger. The aneurismal swelling then sloughed, and a deep and extensive wound was the result; but the child's powers of constitution carried it through both the acute attack and the protracted process of reparation. I have no doubt that, in this case, the injected fluid became immediately mixed with the blood, and, reacting upon that fluid, produced some change in it, rendering it unfitted for the purposes of life, or perhaps inflammation in the veins, termed phlebitis. I have never since this case ventured upon the repetition of the operation upon a large nævus, from the fear that the sudden coagulation of so much blood would produce subsequent phlebitis. In such cases I have preferred the application of ligatures.

The application of a ligature around the base of such tumours is a means frequently adopted for their cure, and seems, indeed, to be the safest mode of removing them. Excision should not, in my opinion, be employed for that purpose; for in many instances I have known the lives of children placed in great jeopardy in consequence of the operation, as it is almost impossible to secure every vessel by ligature; and indeed, where, under such circumstances, the bleeding is excessive, the actual cautery is the only means by which it can be checked. Sir Astley Cooper mentions a case in which he had applied nitric acid to a nævus situated at the outer angle of the superciliary ridge, and in which, when the slough came away, a severe bleeding occurred, and could only be stopped by the actual cautery. When ligatures are employed, the kind to be used depends upon the size of the swelling and the looseness of the skin in which it is situated. In a small nævus on the cheek or lips, the simplest kind of ligature is sufficient: it may be applied by passing two small needles through the base of the tumour, at right angles to each other, placing the ligature under them and around the whole mass, and tying it as tightly as possible, so as to completely constrict the vessels by which the swelling is nourished. The ends of the needles may then be cut off short; or if the base of the swelling be but small, they may even be withdrawn. As the tumour ulcerates, the ligature of course becomes loose, and must be replaced by another, to keep up the constriction. The implication of the skin causes great pain, and the progress of the sloughing is very slow; so that this mode of proceeding ought only to be employed when the tumour is small. Some surgeons recommend that, before the application of the ligature, a crucial incision should be made through the skin, which should then be dissected off the subcutaneous erectile tissue, the latter alone being comprehended in the ligature: this plan deviates, however, but little from the total excision of the tumour, as the bleeding in dissecting off the skin is very profuse, and I have been obliged, in attempting this operation, to apply the ligature without loss of time around the whole mass, in order to check the hæmorrhage; and had the tumour been too large to have permitted of this, I believe the patient would have died from loss of blood. The late Mr. Liston always employed, and I think first proposed, a most ingenious arrangement of ligature for the constriction of large nævi: in this operation, the tumour is first raised as completely as possible from the subcutaneous structures: a long needle, fixed in a handle, but without a ligature, is then passed through its base, below the diseased tissue; a second needle, threaded with a double ligature, is passed in a similar manner, but at right angles to the first; the first needle is next threaded, and both then withdrawn, leaving the ligatures in the tumour; the loop of each double thread is next cut, so that four single threads now cross the swelling, each with two free extremities. In securing this system of ligatures, every free extremity is tied to the nearest thread of the next pair, without being tightly drawn; but the two last are tied as tightly as possible, and as they command all the others, the degree of constriction depends entirely on the force with which they are secured.

I have myself employed this ligature in several cases, and am convinced by experience of its great utility. On one occasion I modified the operation for the purpose of avoiding the constriction of the skin. The modification I speak of consists in making a section of the skin in each fourth of the tumour included between the pairs of ligatures, so that when the latter are tied the constriction is confined to the subcutaneous structures, leaving the integument comparatively free. One of the advantages derived from this segmental division of the skin is found in the immediate stoppage of bleeding as soon as the two ligatures are tied, including the portion incised; while if the whole circumference were included in a continuous section, the hæmorrhage could not be stayed until all the ligatures were secured, during which time a dangerous loss of blood might occur.

Dr. Lewis, of Finsbury-place, sent me a child who had a large nævus on the extremity of the chin, extending upwards towards the left corner of the mouth: as the skin was very loose, and the tumour compressible, I did not in this case think it necessary to divide the skin as I have just described, but included it in the ligature. Upon the completion of the operation I found that a portion of the tumour, about the size of a large pea, had escaped the constriction, but I did not regard this as a matter of much importance, believing that the subsequent inflammation of the tied mass would produce the obliteration of the vessels of the unconstricted part as well as of those included in the ligatures: my expectation was not, however, realized, and a fresh ligature was required to remove the remaining part of the tumour. Mr. Wilkinson, of Princes-street, brought a child to me with a nævus on the lower lip: the tumour was about the size of a hazel nut, and projected more into the mouth than it did externally: the skin was not much discoloured. In this case I determined upon applying the ligature to the mucous surface of the lip: I effected this very easily, and so far effectually that the constricted part soon sloughed off; but as the wound cicatrized, the lip became inverted, and produced considerable deformity; this was, however, permanently removed, by dividing the frænum and mucous membrane of the lip at its point of reflexion from the lip to the gum. A young lady, Miss G., consulted Sir Astley Cooper for a large erectile tumour, of the class I am describing; it occupied the space between the coronal suture and the right superciliary ridge; it was easily compressible, and a thrilling noise was audible, caused by the passage of the blood through the tumour. The skin was of a dingy brown colour, but became converted into a dark red under the least excitement; large tortuous and strongly pulsating arteries could be seen and felt entering the tumour, running from the occipital, temporal, and supra-orbital branches; on the right side the arteries were much larger than on the left, and when pressure was made upon these vessels, the tumour became flaccid and smaller. This circumstance induced Sir Astley Cooper to put ligatures upon the vessels leading to the tumour, in the hope of cutting off the supply of blood; but as soon as one vessel was obliterated, another anastomosing branch became enlarged, and an equally large quantity of blood was sent to the swelling; and although four large branches were successively tied, the disease continued unrelieved. Pressure was next tried, but this also proved ineffectual. Miss G. then consulted Sir Benjamin Brodie, and he applied ligatures for the constriction of the tumour, and ultimately succeeded in curing the disease.

Dilatation of arteries.—The arteries are liable to a change in their physical condition, inducing a dilatation which can neither be classed with that disease just described, nor considered as true aneurism. This condition is produced in an artery by the loss of the natural elasticity of its coats; so that, when the vessel is distended by the impulse of the blood, it is incapable of contracting to its original size, and consequently becomes gradually but permanently more and more dilated. This change does not generally extend to the whole of the circumference of the artery at the dilated part, but is confined to a circumscribed space, and frequently seems to be produced by the blood impinging more forcibly at one point of the artery than at another: hence this dilatation is very frequent at the point in the ascending aorta where that vessel begins to form the arch, and where it naturally receives the strongest impulse of the blood as it is propelled from the heart. Dilatation is also frequent at the origin of the cœliac axis; but these enlargements do not constitute true aneurism, as the continuity of all the coats of the artery remains undisturbed, and the blood flowing through the vessel retains its fluidity: while aneurism is produced by the internal coat giving way, and coagulated blood being invariably found in the pouch formed in consequence of that lesion. Dilatation of an artery must not, however, be attributed exclusively to physical causes; for in such cases there can be no doubt that some morbid change is first produced in the coats of the vessel by defective nutrition, probably referable to an altered action of the vasa vasorum. The direction in which dilatation of an artery takes place depends upon the resistance offered by the surrounding parts, being always towards that side on which the resistance is least. If the obstruction be equal on every side, the direction of the dilatation will be governed by the impulse of the blood: for instance, in the ascending aorta the enlargement would probably be upwards and to the right; in the arch of the aorta, upwards and backwards; in the carotid it would be outwards, in the abdomen forwards, in the axilla downwards, in the groin forwards, and in the popliteal region backwards. The diagnosis between dilatation and true aneurism is often extremely difficult: if it be situated in the ascending aorta, it may press in the same manner as true aneurism upon the superior cava, and thus interfere with the return of the blood to the heart; the impediment is, however, less in degree, and not permanent; the bruit is also very indistinct, if present at all; and from these differences a tolerably correct inference can generally be drawn. The constitutional treatment would be the same in either case: in both the great object would be to keep the patient free from excitement, such remedies being at the same time employed as tend to diminish the action of the heart; nourishing but non-stimulating diet should also be prescribed, so that the powers of the constitution may be maintained, in order to prevent the accession of that irritability inseparable from depletion. If, however, the patient be of a full habit, the abstraction of small quantities of blood will produce the most beneficial effects. I believe, indeed, that dilatation of an artery may be permanently cured by the employment of these means, which operate by restoring the healthy action of the vasa vasorum, which are thus rendered capable of conveying to the arterial coats their normal supply of nourishment.

ANEURISM.

Aneurism may be divided into two kinds—spurious and true aneurism.

Spurious or diffused aneurism may be produced by puncture in an artery, the integument having healed over the wound; or by the rupture of the vessel without any external wound; or, thirdly, it may arise from a diseased state of the coats of an artery which are rendered incapable of withstanding the natural impulse of the blood. Under either of these conditions the blood becomes diffused into the surrounding tissues, unconfined by any sac beyond that formed by the inflammation ultimately induced in the surrounding cellular membrane by the presence of the blood.

Aneurism arising from puncture of an artery will be more conveniently treated of when I speak of wounds in the arteries. I shall therefore at present direct your attention to what is termed *diffused aneurism.* This affection, arising from the rupture of a large artery, without any external wound, is of very uncommon occurrence. The following case offers, however, a good example of this injury:—

A patient named Weever was brought into Guy's Hospital with simple fracture of the thigh-bone. From the extent of tumefaction, the splints could not be applied for some days; and when they were placed on the limb, in producing the coaptation of the fractured bones, the patient expressed his conviction that something had given way in his leg, and a sudden increase of swelling took place. In the afternoon of the same day my attention was called to the patient, and upon examination I found a large fluctuating tumour, strongly pulsating. It immediately occurred to me that the femoral artery had been lacerated, and this view was corroborated by the circumstance that neither the anterior nor posterior tibial arteries could be felt at the foot. I now at once determined upon cutting down upon the femoral artery, which I did without removing the patient from his bed. I made the incision in the upper third of the thigh, and as soon as I had applied the ligature to the femoral artery, the pulsation of the tumour ceased, the effused blood was gradually absorbed, and the fractured bone united with more than usual rapidity. The latter circumstance may, perhaps, be accounted for by the fact that the obliteration of the superficial femoral artery caused a greater quantity of blood to be sent to the bone by means of the profunda branch.

About three years ago I was sent for to Bishops-Stortford, to a case of severe fracture of the thigh, in which there were indications of extensive effusion of blood; but as there was no pulsation, it was very difficult to ascertain whether an artery or vein had been lacerated; for the absence of pulsatory motion was not of itself sufficient to prove that a vein only was ruptured, as the pressure arising from a large effusion of blood might be sufficient to prevent pulsation, even if an artery were the subject of the lesion; and as in this case the limb had been placed by the medical attendant in a good position, I did not interfere with his arrangements. Three days after, however, I paid another visit to the patient, when I found the tension of the limb much diminished, and pulsation still absent. These circumstances proved both that the hæmorrhage had ceased and that the effused blood was venous. As the quantity of blood had been originally very great in this case, I thought it better, although it is not usually my practice, to make an opening in the upper part of the thigh, for the evacuation of the accumulated fluid. This patient also recovered, but the union of the bone took place but slowly. Although this was not a case of lacerated artery, I have introduced it in this part of the subject to show the difficulty that may occur in the diagnosis between rupture of an artery and that of a vein.

The sudden giving way of an artery from disease is a very rare occurrence; there are, however, some cases recorded in which the aorta has burst, from the force of the blood, without the formation of a true aneurism, the patient dying from extravasation of blood into the cavity of the abdomen. The arteries of the brain seem more susceptible to this lesion than those of any other part of the body, and the basillary artery has been known to give way without passing through any of the ordinary steps of aneurismal disease.

LECTURE LVIII.

CONTINUATION OF THE DISEASES AND INJURIES OF THE VASCULAR SYSTEM.

True aneurism—Definition of—Progress of the disease—Diagnosis.

Internal aneurism—Aneurism of ascending aorta—Symptoms and diagnosis—Aneurism of the arch of the aorta—Symptoms—Effects on the surrounding tissues—Diagnosis by auscultation—Aneurism of abdominal aorta—Its first indication—Symptoms—Case—Fatal termination of internal aneurism—Depends upon the organ into which the hæmorrhage occurs—Treatment of internal aneurism can be only palliative—Cases.

External Aneurism—Diagnostic signs—More than one aneurism found in the same individual—Cases—Period of life most obnoxious to aneurism—Spontaneous cure—How effected by nature—Cases.

Wounds in arteries—Classification of—Means of arresting hæmorrhage—Cases.

TRUE ANEURISM.

A TRUE aneurism may be defined as a pulsating tumour communicating with the interior of an artery, and containing coagulated blood; the latter circumstance arises from the lesion of the internal coat of the artery, the function of which seems to be the maintenance of the fluidity of the blood; when, therefore, any morbid change takes place in the lining tunic, or it becomes ruptured, the point of lesion is filled by a coagulum of blood, and the aneurismal condition takes its commencement. The quantity of coagulated blood progressively increases by the deposit of fresh portions of fibrine, which are arranged in concentric laminæ; this mass presses upon the fibrous coat of the artery, and constitutes a small pulsating tumour, the size of which depends upon the extensibility of that coat; fresh deposits take place within the artery, and the middle coat becoming ultimately stretched beyond its power of resistance, gives way, and the external coat is alone left to constitute the sac of the aneurism; this elastic coat of the artery continues to yield to further depositions of coagulum so long as it retains its physical power; indeed, it becomes in some degree strengthened by a deposit which is formed on the outside of the sac, in consequence of the irritation excited by the pressure. The progress of the disease remains, however, unchecked, for the deposit of fibrine is still constantly going on within, until, finally, the external or elastic coat of the artery gives way by absorption; the deposited adhesive matter now constituting the only boundary to the aneurism. The disease continues to advance, however—tissue after tissue is interstitially removed; even bone can oppose no effective barrier to the destructive influence, and after a while the skin alone remains intact; this, in its turn, gives way; repeated hæmorrhages occur, and the patient dies from the effect of loss of blood on the constitutional powers.

Sometimes it happens that the blood coagulates so firmly and rapidly within the sac as to cause its obliteration, by exciting inflammation in the artery on the proximal side of the aneurism, and leading to adhesion of the sides of the vessel, destroying it as a means of circulating the blood; the aneurism is therefore spontaneously cured.

Diagnosis.—The power of forming a correct diagnosis in a case of aneurism must depend in a great measure upon the situation of the tumour—as to whether it exists within the cavities of the trunk, or in the extremities or neck, the facility in diagnosis depending upon the proximity of the tumour to the surface; when it exists within the cavities its presence is rather indicated by its interference with the functions of some important vital organ, than by its own physical characters, which are indeed, from the depth at which the disease is placed, beyond investigation.

INTERNAL ANEURISM.

Aneurism of the ascending aorta.—This aneurism is generally first suspected in consequence of its pressing on the superior cava or pulmonary artery; if on the first, it interferes with the return of the blood from the head and neck, producing a livid suffusion and œdema of the face; while if the pressure be on the pulmonary artery, the function of respiration is much impeded. In this aneurism the symptoms are sometimes very similar to those in disease of the heart, the pulse being feeble and intermittent; it is also often attended by an irregular action of the heart itself, with a sense of constriction across the chest.

Arch of the aorta.—When the arch of the aorta is the seat of aneurism, the tumour soon becomes obvious by its extending itself upwards, towards the upper extremity of the sternum, so that the pulsation may be felt in the lower part of the neck: as the swelling increases in size, it presses backwards on the trachea, offering an impediment to the passage of the air, and giving rise to a degree of dyspnœa and alteration in the tone of the voice highly characteristic of the disease: if the aneurismal dilatation be situated to the left of the centre of the arch, dysphagia will form a prominent symptom, owing to the pressure of the tumour on the œsophagus; and should the pneumogastric nerve be at the same time involved in the pressure, difficulty of breathing and dyspepsia would be characteristic features of the complaint. When any portion of the thoracic division of the descending aorta is the seat of aneurism, the symptoms are very obscure, and may be mistaken for those of phthisis: cough being invariably present, owing to the pressure of the tumour on the lung. A diagnosis may, however, be formed from the circumstance that in aneurism nothing but frothy mucus is expectorated; while in phthisis, pus is mixed with the expelled fluid. The tumour may also interfere with the functions of the thoracic duct, leading to marasmus; or it may press on the vena azygos, in which case the muscular actions of the thorax would probably be interrupted. As the tumour increases, the pressure sometimes produces interstitial absorption of the dorsal vertebræ and ribs, so as to permit of the extension of the morbid growth towards the surface of the back, not unfrequently causing paralysis below the diseased part, in consequence of the pressure on the spinal marrow. The presence of the above symptoms would necessarily give rise to an examination by auscultation, when it would be found that the pulsation was attended by a bruit which would probably lead to the formation of a just diagnosis.

Aneurism of the abdominal aorta.—This aneurism is usually at first indicated by disturbance of the function of some of the important vital organs contained within the cavity of the abdomen. From the size of the aorta, it being in fact the great systemic trunk, when any portion of it becomes the seat of aneurism, there is a tendency to sudden faintness under exertion, particularly in such motions of the body as compress the sac; for instance, in the act of bending the thigh upon the body. The following is a case illustrative of this:—A surgeon, from Woolwich, consulted me, stating that he often felt a sudden faintness come over him when raising his foot to the stirrup in mounting his horse, but that it left him again as soon as he brought his foot to the ground; a disagreeable sensation remaining, however, for some time after in the epigastric region. I made a careful examination of the abdominal region, and discovered a pulsating tumour about half-way between the umbilicus and ensiform cartilage of the sternum; but there was a difficulty in determining whether the pulsation arose merely from the proximity of a solid tumour to the aorta, or whether the tumour communicated with the interior of that vessel. I hit upon the following plan of examination to decide the point:—I requested my patient to place himself on his hands and knees on the floor; I then stood over him, and placed my hands beneath his body, so as to sustain, as it were, the weight of the tumour as it fell forward from the aorta. I adopted this mode of investigation because I considered that if the tumour derived its pulsation from its contiguity to the artery, it would lose it in the position I have described; but I found the pulsation to continue with unabated strength, and that it increased in proportion to the amount of pressure I exerted upon the tumour; I therefore felt satisfied as to the disease being aneurism: I did not express this opinion to the patient, but the next day saw him again with Sir Astley Cooper, who, after a lengthened examination, fully agreed with me in the diagnosis I had before formed: the patient soon after died suddenly, from the bursting of the aneurism into the cavity of the abdomen. Aneurisms of the abdominal aorta often project posteriorly to such an extent as to form tumours in the loins, and under some circumstances these may not communicate to the hand the pulsatory motion that may be expected to form their principal diagnostic feature: great care is therefore requisite in inquiring into all the circumstances connected with such a tumour and its growth, for if it were mistaken by any chance for lumbar abscess, and punctured, the error would probably be attended with a fatal result. Sir Astley Cooper has quoted such a case in his surgical lectures; but in this instance the wound fortunately healed; the patient ultimately dying from the spontaneous bursting of the aneurism.

Internal aneurisms terminate fatally by hæmorrhage, either into the serous cavities or into some important organ with which they have been made to communicate by the process of ulceration. The ascending aorta sometimes bursts into the pericardium, destroying life immediately, by the pressure of the blood interfering with the action of the heart. The arch of the aorta may burst into the cavity of the chest or into the trachea or bronchi: if into either of the latter a large quantity of blood would be thrown up; but this does not always destroy the life of the patient at once, as the ulcerated opening into the aneurism and windpipe may become plugged with coagulum, so as to restrain the hæmorrhage for the time: this happened in the case of the late Mr. Liston, who brought up more than a pint of blood at the first hæmorrhage, but lived for some weeks after. When the aneurism bursts into the œsophagus, hæmatemesis occurs; but here also it is not the first effusion of blood, but its frequent recurrence, that destroys the life of the patient. The bursting of an aneurism of the descending thoracic aorta may happen either externally or internally to the cavity: when internally, the blood may be discharged into the lung, œsophagus, or posterior mediastinum; if into the latter, the effused blood might make its way through the diaphragm into the abdomen, in which case the hæmorrhage would probably prove at once fatal, as there would, under these circumstances, exist less impediment to the flow of the blood than when the aneurism opens into the lung or œsophagus, where adhesions may perhaps have been formed, tending to diminish the size of the orifice through which the blood escapes. When aneurism is seated in the abdominal aorta, it may open into the stomach, intestines, or cavity of the abdomen; vomiting or purging of blood would denote its effusion into the stomach or intestines; and sudden death, with tumefaction and a remarkably anæmiated state of the surface of the body, would indicate the bursting of the sac into the general cavity of the abdomen.

Treatment of internal aneurism.—In aneurism there can be but little hope of cure from medical treatment, but at the same time the symptoms may be palliated to a great extent, and the life of the individual prolonged; and as there are many instances recorded of the spontaneous cure of aneurism, even of the larger arterial trunks, it is desirable that every means should be employed to promote the efforts of nature to establish a curative action.

To show how much advantage may be derived from judicious medical treatment of this disease, I will describe a case which came under my notice many years since. A poor woman, forty years of age, came to consult me for aneurism in the arch of the aorta: her occupation was that of retailing coals, and she was constantly exposed to considerable exertion. Upon examination I found a tumour as big as a pullet's egg projecting above the sternum: the skin was already discoloured, the pulsation very strong, and there was great difficulty in breathing, owing to the tumour pressing upon the trachea. The patient stated that she was sometimes seized with fits of coughing, which brought on great confusion in her head, and she felt as if she were going to die suddenly; indeed, when she first came to me, I thought from the urgency of the symptoms that she could not live a fortnight. I ordered her to abstain from every kind of exertion, and that ℥vj. of blood should be taken from the arm. I prescribed also gentle saline medicines, with small doses of digitalis. A few days after I first saw her, she came to me again. I was surprised at the favourable effect the treatment had produced: she was under the impression that she was permanently cured, and I could scarcely persuade her that she was quite unfit to resume her former occupation: this patient lived two years, being occasionally bled to a slight extent (about two or three ounces); ultimately, however, she died suddenly, from the bursting of the aneurism into the trachea.

Some years ago a woman was admitted into St. Bartholomew's Hospital, under Mr. Earle, with aneurism of the arteria innominata. Upon consultation it was deemed an unfit case for surgical operation, and Mr. Earle therefore determined to try the effect of remedial treatment in producing a spontaneous cure, and ordered repeated small bleedings, rest, and cold applications to the tumour. The swelling very soon diminished in size, and at the end of three weeks the pulsation had nearly ceased: at this period, however, on the repetition of venesection, phlebitis unfortunately followed, and the patient died.

Upon a post-mortem examination, the aneurismal sac, which was situated just at the bifurcation of the artery, was found nearly obliterated, and the surgeons all concurred in the opinion, that but for the untoward termination of the case, which was indeed totally unconnected with the original disease, the aneurism would have undergone a spontaneous cure.

The above cases illustrate the principles upon which the treatment of aneurism is based, modified of course according to the circumstances arising in each particular case. Perfect rest is of all things most essential in this treatment. Wherever Nature effects the spontaneous cure of aneurism, she attains her object by the coagulation of the blood contained in the sac, and therefore many methods of producing such a condition artificially have been proposed; among others the transmission of a galvanic current through the sac, for the purpose of producing coagulation of the serum of the blood, thus contributing to fill up the sac completely. I should, however, fear that the excitement of such an operation would be more likely to produce permanent mischief than a beneficial effect.

There are preparations extant of the spontaneous obliteration of the aorta itself, the circulation being carried on by collateral branches. Sir Astley Cooper tied the abdominal aorta several times in the dog, and always with success; and in one case of aneurism of the external iliac artery which had burst, he was induced to perform the operation of tying the abdominal aorta in the human subject: but even if this operation were considered admissible in case of the bursting of an aneurism, it would still, in my opinion, remain a question whether it could be resorted to in case of injury to an artery—by a stab, for instance—as in the latter case the collateral vessels would not be prepared, as in aneurism, to carry on the circulation of the blood, which after the obliteration of the aorta would depend entirely upon them.

EXTERNAL ANEURISM.

An aneurism is so termed when the diseased artery is situated either in one of the extremities, or the neck, or indeed whenever it is external to the cavities of the trunk, and in consequence of the arteries of the extremities being constantly exposed to the action of strong muscles, they become, when there is any predisposing tendency to aneurism, especially subject to it. The arteries of the lower extremity are more liable to aneurismal affections than those of the upper extremity or neck, and, as might à priori be supposed, in consequence of the greater muscular exertion to which he is subjected, it is more frequent in man than in woman.

Diagnosis.—The diagnosis is easier in external than in internal aneurism; but still pulsation, the great characteristic of an aneurismal tumour, is not always very evident even in external aneurism; this may depend upon the firmness of the coagulum within the sac, the freedom with which collateral branches are performing the functions of the diseased trunk, or perhaps upon the want of power in the heart's action, but under these circumstances the peculiar pulsatory motion of an aneurism may be detected by making pressure on the artery on the distal side of the tumour, which invariably tends to increase the pulsatory motion. This diagnostic mark alone is not, however, sufficient to prove the existence of aneurism, as a swelling which derives pulsation from an artery might have it in some measure increased by this mode of proceeding: when, therefore, pulsation is detected, to prove that it results from the cavity of the tumour communicating with the interior of an artery, the vessel should be compressed on the proximal side of the swelling, this would necessarily check its pulsation, and the tumour, if aneurismal, would become *flaccid;* but upon removing the finger, it would immediately recover its original size, conveying forcibly the idea of a fluid pouring into an empty bag. This mode of examination is also sufficient to distinguish between an aneurism and a solid swelling to which a pulsatory motion is given by an artery passing over, under, or through it; for although in this case, as in aneurism, the pulsation will be stopped by pressing the artery on the proximate side of the tumour, still there must be a perfect absence of that state of flaccidity and subsequent increase which instantly results in aneurism from the removal of the pressure. The diagnosis may be rendered complicated and difficult by the tumour itself containing fluid matter, as might occur from abscess or encysted tumour, in which case the fluid itself would partake of a pulsatory motion; but even under such difficulties a diagnosis may be formed, from the fact that the swelling was not diminished in size by pressure made on the artery between the swelling and the heart.

The difficulty of the diagnosis between a tumour merely partaking of the pulsation of an artery, and an aneurism, may, however, prove insuperable even to the most experienced surgeon. In illustration of this there is preserved in the museum at St. Bartholomew's Hospital an injected preparation of a half of the thorax of a patient in whom Mr. Earle had tied the subclavian artery for what he considered an aneurism of the axillary artery. The patient was admitted into the hospital six years after, and died, when it was found, upon post-mortem examination, that aneurism had never existed, but that a tumour of the median nerve had pressed upon the artery, and produced the symptoms of aneurism. There is also in the same museum another preparation, in which the femoral artery had been tied for a pulsating tumour in the leg, supposed to be an aneurism. The patient died from sloughing of the tumour, when, upon examination, it was proved to be a disease in the tibia; and, what was singular, the absorbent glands of the groin were converted into bony matter.

It is not uncommon to find more than one aneurism in the same individual; and Sir Astley Cooper mentions a case in which seven were found in the same person in whom he had tied the external iliac artery; the patient died some months after from the bursting of an aneurism, at the bifurcation of the aorta, into the cavity of the abdomen. In another instance Sir Astley Cooper had made the first incision in the operation of tying the femoral artery in a case of popliteal aneurism, when suddenly the head of the patient fell back, his urine flowed involuntarily, he gave a gasp, and instantly died. Upon post-mortem examination it was found that an aneurism of the ascending aorta had burst into the pericardium.

Mr. Tyrrel tied the femoral artery in a man who had femoral and poplitcal aneurism on the same side. The patient died, and on examination of his body it was found "that the popliteal and one of the femoral aneurisms had been destroyed by sloughing, but that the one above the ligature was not closed. On the right side were found three femoral and a small popliteal aneurism, making in all seven, besides a dilatation of the aorta immediately above its bifurcation." There are now living in London three persons in whom I have tied both femoral arteries for popliteal aneurism: one of them, who is porter to an orange merchant, states that he feels as capable as ever he did of carrying a chest of oranges weighing two hundred weight. The cases of Sir Astley Cooper and Mr. Tyrrel, just quoted, afford strong examples of the necessity for a strict examination of the patient before he is submitted to an operation for aneurism; for it becomes a serious question whether an individual who is the subject of aneurism of the aorta and popliteal artery at the same time ought to be subjected to the operation of tying the femoral artery for the cure of the popliteal aneurism.

The period of life at which aneurism generally occurs, seems to be that at which the muscular system is at its full development, and between the ages of 30 and 50 is perhaps the time at which the disease is usually met with. Sir Astley Cooper states that he tied the femoral artery of a man 80 years of age, and the earliest age at which he had ever known aneurism to exist was 11: this was in the case of a boy who had aneurism of the anterior tibial artery.

Borot ("Recherches sur l'Aneurisme") states that out of 108 cases which he had investigated—

1	was under the	20th year
15	between	20 and 29
35	"	30 " 39
31	"	40 " 49
14	"	50 " 59
8	"	60 " 69
2	"	70 " 79
2	"	80 " 89
108		

Although I have myself operated for aneurism more than thirty times, I have never had a patient under 28, nor beyond 64 years of age.

Spontaneous cure of aneurism.—In a former part of the subject I stated that aneurism even of the aorta sometimes undergoes spontaneous cure from the firm coagulation of the blood within the sac completely filling and finally causing its total obliteration. This natural process of cure may also arise in an external aneurism; and quiescence of the limb, slight compression, keeping the limb elevated, application of cold to the part, and judicious diet, may all assist in promoting the efforts of nature to establish this restorative action. Spontaneous cure of an aneurism may also be induced by other circumstances besides the obliteration of the sac itself: the position of the tumour may be such, for instance, as to cause it to press upon the proximal part of the artery with sufficient force to produce obliteration of the latter; and a case is mentioned by Sir Astley Cooper in which the carotid artery became obliterated by the pressure from the sac of an aneurism of the aorta. Sloughing of the sac has sometimes extended to the artery above the aneurism, causing coagulation of the blood, and thus leading to spontaneous cure of the disease. Mr. Goodwin, the Queen's veterinary surgeon, related to me a case he witnessed in St. Petersburgh. A patient of Dr. Arnendt, of that city, was the subject of an aneurism of the external iliac artery, just at Poupart's ligament. Dr. Arnendt determined on tying the artery; but on the day appointed for the operation severe hæmorrhage occurred, which rendered it necessary that the operation should be postponed: in the meantime sloughing commenced, and ultimately spontaneous cure of the aneurism was effected.

On the 20th of January, 1847, a patient, 35 years of age, was admitted into Guy's Hospital, in consequence of the bursting of a femoral aneurism: it had given way just below Poupart's ligament, and had produced a great effusion of blood, rendering the limb twice its natural size. Very slight pulsation could be felt either in the aneurism or in the effused blood; but I thought it right to secure immediately the left external iliac artery. The ligature came away on the twenty-second day, and the patient recovered without any bad symptom occurring. A question may, however, arise as to whether I ought not in this case to have waited to ascertain if nature would not, by means of the effusion, have established a spontaneous cure; but I consider that the quantity of blood effused was likely to lead to the obliteration of the collateral branches as well as the diseased trunk, and the danger of sphacelus led me to the step I have described.

The foregoing history of external aneurism sufficiently shows the necessity for either medical or surgical aid, and the choice to be made must depend upon the judgment of the surgeon as to whether the condition of the patient promises a just hope of the cure being spontaneously effected through the medium of the constitutional powers, aided by medicine, or whether the radical cure is at once to be attempted by compression or by the application of a ligature on the proximal side of the aneurism: as wounded arteries, however, require precisely the same treatment, before I describe that to be employed in each particular kind of aneurism, I shall give a general account of the effects and treatment of wounds of arteries.

WOUNDS IN ARTERIES.

A wound in an artery may be the result of puncture or incision, and may be oblique, longitudinal, or transverse, or the artery may be cut completely through, or the wound may be produced by laceration, or by mere contusion, which may lead to subsequent lesion and secondary hæmorrhage. Under any of these circumstances a ligature may be necessary to prevent the ill effect of the bleeding.

In a punctured wound of an artery, such as is sometimes produced accidentally in the operation of phlebotomy, it is not always necessary to put a ligature around the vessel; as I have already stated, the arterial coats are as highly organized as the other tissues, and equally capable with them of undergoing the adhesive inflammation. The wound may therefore heal if sufficient pressure be applied to prevent the blood from flowing through it; and at the same time, if the opening be but small, the continuity of the canal may be preserved.

If the wound in the artery be oblique or transverse, it has a tendency to gape open, in consequence of the elasticity of the coats; and in such cases pressure rarely produces adhesive obliteration of the opening; but should compresses permanently check the hæmorrhage, obliteration will be effected by the effusion of blood, which, coagulating, fills up the opening, causes inflammation of the internal coat of the artery, and, finally, completely seals up the canal. After this, the blood has to be conveyed to the more distant parts by means of the collateral channels.

When an artery is completely cut or torn through, the truncated extremities of the vessel retract into the surrounding cellular tissue: the lesion in that case is very irregular, in consequence of the unequal elasticity of the three coats. This irregularity is of itself sufficient to retard the flow of blood, and facilitate the coagulation, which, unless the artery be of very large size, will not only stop the bleeding at first, but also produce permanent adhesion in the internal coat of the divided vessel. Complete division of an artery is, indeed, much less likely to lead to the necessity for ligature, than its partial division: the knowledge of this circumstance often gives rise to a peculiar treatment, when blood is drawn from the temporal artery; when a sufficient quantity of blood has been taken from the vessel, the latter is cut quite through, and pressure applied to prevent recurrence of the bleeding. If pressure alone be applied to the partially divided artery, an aneurism may subsequently be formed, and would probably require a surgical operation for its cure. This method can, however, only be adopted with respect to those vessels that are placed in such a position that they may be readily compressed upon bone; and where an artery is punctured, which, from its situation, cannot be thus subjected to compression, a ligature must be placed on the vessel both above and below the opening.

Laceration of an artery, even when the vessel is of large size, is often unattended by hæmorrhage. This circumstance arises, as I have already said, from the difference between the three coats with regard to their elasticity, consequently, when the vessel is torn through, an irregular ragged opening is formed, in which the blood readily coagulates, and the bleeding is spontaneously checked. This is particularly seen in gunshot wounds; and cases are recorded of amputations having been performed in which bleeding had only occurred from the collateral branches, and not at all from the main trunk.

Contusion of an artery sometimes leads to secondary hæmorrhage from sloughing of the injured vessel, owing to its vasa vasorum having been destroyed by the injury; but more commonly a coagulum forms in the vessel, and prevents bleeding by establishing subsequent adhesive inflammation in the internal coat.

Means of arresting hæmorrhage.—There are various methods of effecting this object—viz., styptics, cautery, torsion, compression, and ligature. *Styptics* are but seldom employed to arrest bleeding from a single vessel, but they are often very available in cases where, either from the peculiarity of diathesis, or unnatural local vascularity, diffused hæmorrhages occur. One of the best styptics I know is a saturated solution of alum : but various preparations are sold for this purpose. Excepting, however, under the circumstances I have mentioned, no reliance can be placed on them as a means of stopping bleeding, and at the present time a surgeon would not think of trusting to such means, while ligature or the actual cautery could be had recourse to. It would, therefore, be useless to enter into a lengthened account of the different compounds that have been recommended for the purpose of stopping hæmorrhage.

Actual cautery is, perhaps, next to ligature, the most certain means that can be adopted to restrain the flow of blood from a ruptured or wounded vessel, and can often be employed where a ligature is inadmissible, as in those operations in which bones are implicated, especially the bones of the face; and no surgeon should undertake the removal of a part of the upper jaw, for instance, without being prepared with the proper apparatus for the application of the actual cautery. An instrument which I use for the purpose consists merely of a small rod of polished iron, furnished with a sheath: in the operation the sheath is passed to the mouth of the bleeding artery, and the heated rod then inserted and pushed along this canula, until it reaches the artery, which it cauterizes without danger of burning the surrounding parts. I once succeeded completely in stopping by this means a severe hæmorrhage which followed the extraction of a tooth. A frequent method of checking bleeding from this cause is by driving a peg of wood into the alveolar process; but although this plan may prove effectual, it is to be remembered that a foreign body is introduced into the living bone, and may be the cause of much future mischief.

Torsion.—The French surgeons have recommended torsion instead of ligature, when the bleeding vessel is of secondary size; but I have found very little certainty in this treatment, although I believe that failure often results from the imperfect manner in which the operation is performed: it is requisite that the bleeding vessel only should be seized by the forceps, and that a sufficient degree of tension should be applied to it to tear through the cellular connexion: thus depriving the vessel of nutrition by rupturing the vasa vasorum, and at the same time producing lesion of the internal coat: *torsion* is then applied merely for the purpose of destroying the physical elasticity of the outer coat; but if any of the surrounding tissue be taken up as well as the artery, it will be found difficult to effect the objects required. It may be asked, what are the proposed advantages of torsion over ligature? It does away with the necessity for the introduction of a foreign body into the wound, and consequently avoids the difficulties that may subsequently arise in the separation of the ligature. Still I am of opinion that torsion should never be attempted excepting in the smaller vessels. I have frequently found it useful in the extirpation of the mammæ, when the hæmorrhage has been troublesome from numerous small arterial branches; for if a ligature had been applied to each of these, an injuriously large amount of extraneous matter would have been introduced into the wound.

Compression is a further means of checking hæmorrhage; and it is also now employed for the cure of aneurism. When used as a means of stopping bleeding, it should not merely be applied upon the wound in the vessel itself, but the bandaging should be so employed as to modify the circulation throughout the whole limb;—as, for instance, in a deep-punctured wound in the palm of the hand, followed by hæmorrhage, which it is thought advisable to attempt to restrain by compression, a bandage should be first applied round each finger separately, and then continued around the hand, a compress being placed immediately over the wound. The bandage should be continued up the fore-arm, and small compresses of cork placed on the radial and ulnar arteries, with sufficient pressure to diminish without wholly stopping the supply of blood to the hand. The bandage should be continued with a moderate degree of tightness as far as the shoulder.

The patient ought to be kept in the recumbent position, and a low equable temperature maintained in the arm by the application of cold water. A gentle immediate compression may, however, be sufficient without the employment of the gradual compression by bandage. The following is a good illustrative case of the staying of hæmorrhage by compression:—

George Paris, aged 10, was admitted into Guy's Hospital, 4th June, 1846. Five weeks before his admission, he received a severe wound just above and to the inner side of the left wrist. A considerable flow of arterial blood immediately followed the accident: the bleeding was restrained at the time by compression, but recurred on various occasions whenever the bandages were loosened, so that the boy's health began to be affected by repeated losses of blood. When he was brought into the hospital, there was a wound about three inches in length, extending obliquely from the styloid process of the ulna upwards and outwards towards the radius, and filled with large glassy granulations, vulgarly called proud flesh. As soon as the pressure of the bandage was taken off the wound, the bleeding immediately recommenced, the blood appearing to flow from the whole surface, rather than from a single bleeding vessel. Pressure was therefore again applied, and was required to be so strong as to destroy all sensation in the hand; it was therefore removed, when the hæmorrhage quickly returned. A tourniquet was then applied to the brachial artery. Upon examination, it was found that pressure upon either the radial or ulnar artery did not check the bleeding, but that slight continued pressure on both did so effectually. I therefore ordered a piece of cork to be placed upon those arteries, about two inches above the wound, the pressure being sufficient to diminish the flow of blood, but not to stop it entirely: the hand was at the same time raised and kept cool by an evaporating lotion. This treatment succeeded perfectly, the wound in the artery healed, and at the end of the month the patient was discharged quite well.

A boy, aged 15, wounded the palm of the hand with a piece of broken glass. Arterial bleeding immediately followed. A surgeon was sent for, and applied a compress upon the wound, and succeeded in checking the hæmorrhage. At the end of a week, upon removal of the compress, the bleeding recurred, and the compress was consequently re-applied. Successive bleeding, however, followed; and a fortnight after the accident, the boy was admitted into Guy's Hospital, much anæmiated. I immediately ordered gentle compression to be applied by means of pieces of cork placed upon the ulnar and radial arteries, as in the former case; the arm was raised upon pillows, and cold kept constantly applied, and the patient soon left the hospital quite cured.

A third case of the same kind is now in Guy's Hospital, under my care. In January last, a man, 30 years of age, was admitted into Steven's ward, with a severe wound in the back part of his elbow. He stated that a profuse hæmorrhage had taken place at the time of its infliction, and had been checked by bandage, but had afterwards recurred upon several occasions. When he was admitted into the hospital, he was very pallid, had a sharp hæmorrhagic pulse, but no bleeding had taken place for three days. A dose of opium was ordered, and a white-wash poultice applied to the wound. Three days after his admission he had fresh arterial bleeding to a considerable extent. I ordered a tourniquet to be applied to the brachial artery, with sufficient pressure to diminish without checking the circulation. Cold was also applied to the whole of the injured arm. No further bleeding occurred, and in about three weeks he was discharged perfectly cured.

It may be said that the readiest means of stopping the hæmorrhage on these occasions would have been to cut down upon the wounded arteries, and place a ligature above and below the opening in the vessel: but as the accidents had occurred some time before the patients came under my treatment, and as the natural condition of the parts had undergone great change in consequence of the extravasation of blood, I thought it safer to employ the treatment described in the cases, and I feel that the result fully justified my view of the subject.

LECTURE LIX.

CONTINUATION OF THE DISEASES AND INJURIES OF THE VASCULAR SYSTEM.

Wounds of arteries—Suppression of hæmorrhage by ligature—Different kinds of ligatures—Precautions in their application—Effect of placing a ligature on an artery—Case—Separation of the ligature—Operation of applying a ligature—Compression for the cure of aneurism—Applying a ligature around the arteria innominata—Difficulty in diagnosing aneurism of that vessel—Case—Question whether an admissible operation—Description of the operation—Tying carotid artery—Upper and lower operations—Tying subclavian above and below the clavicle—Tying the axillary artery—Steps of the operation—Precautions to be taken—Tying the brachial artery—Operation—Aneurismal varix—how produced—Treatment—Case—Operation.

Suppression of hæmorrhage by ligature.—The means of suppressing hæmorrhage hitherto described are applicable only in cases of diffused bleeding, or where small superficial vessels, or freely anastomosing branches, are injured; they are totally incompetent to stop hæmorrhage in case of lesion of a great artery, and under such circumstances the only mode of procedure which has borne the test of experience is the application of a ligature around the vessel between the heart and the point of lesion, and in some cases on the distal side of the latter also, so as to intercept the flow of blood, until Nature by her own reparative action has rendered the canal completely impervious.

Ligatures of different kinds have been employed by surgeons from the time of Hunter, some having advocated the use of two ligatures applied at short distances from each other, the artery being divided between them; some a broad ligature, or a ligature applied with some substance intervening between it and the artery; and others a thin ligature of silk, or one formed of some substance supposed to be capable of being dissolved and absorbed. When, however, Dr. Jones published his work on this subject, he gave so scientific an account of the effects resulting from the application of a single thin ligature around an artery, as to lead to its general adoption. Many years ago I instituted a series of experiments upon dogs, for the purpose of closely investigating the effect of a ligature upon an artery, and I arrived at the conclusion that a larger ligature than that proposed by Dr. Jones was more efficacious, as in every instance in which it was tried it came away more quickly, and produced a more complete obliteration of the vessel. During the progress of my researches I was anxious to ascertain the effect of forcibly removing the ligature soon after it had been applied, with the view of inducing secondary hæmorrhage, but I could not in any instance produce this result. A question, however, exists as to whether this certain and rapid obliteration of the vessel depended upon its healthy condition or upon the rapidity with which reparation is established in the lower animals: either of these modifying circumstances is sufficient to destroy the analogy between the experiment on a dog and the operation on the human subject. At the same time I am certain that in practice a large silk ligature is preferable to one of small size; I believe, because it divides with equal facility the internal coat of the artery, and is not so liable to injure the external tunic. My late colleague, Mr. Wilkinson King, was of opinion that the division of the internal coat of the vessels by the ligature was not essential to its obliteration, and that this depended upon a direct action of the ligature on the vasa vasorum, external to the vessel. It has, however, been frequently shown, that when a ligature is placed loosely around the vessel, or removed soon after its application, secondary hæmorrhage generally follows, proving, not only that the ligature must be tied sufficiently tightly to divide the middle and internal coat, but also that it must be allowed to remain to be thrown off by nature when the obliteration is completed. In the operation of applying the ligature there is, however, one precaution of great importance, and deserving the closest attention—viz., not to make a more extensive separation of the vessel from its cellular attachments than is positively necessary to permit of the ligature being passed around it; for the obliteration is quickly and securely effected in proportion to the slightness of the disturbance the artery has undergone. Shortly after a ligature has been applied to an artery, the blood begins to coagulate, forming a clot, which extends into the artery both above and below the constricted part: this coagulation takes place with a rapidity proportioned to the diminution of the action of the heart, and is much retarded by any increase in the motion of the blood within the arteries. It occurs more rapidly in the vessels of the extremities than in those nearer the heart, and in small than in large vessels. The length of the clot depends upon the distance of the first large branch from the point at which the ligature is placed: the farther this is off the longer will be the clot. The small branches leading off near the point of constriction are filled by the coagulated blood, which also often partly fills even larger branches, if these be situated near where the ligature is applied. The clot generally fills up completely the cavity of the constricted vessel, but is not adherent to it, excepting where the internal coat is injured by laceration, in which case the coagulum firmly adheres: it cannot, however, of itself, oppose any permanent effective barrier to bleeding from the artery.

In the course of a short period, according to the size of the artery, in consequence of the irritation excited by the clot and ligature, vessels begin to extend into the coagulum from the capillaries of the contiguous coats; a plastic organized substance is then effused; the clot becomes smaller and lighter in colour; it adheres to the internal coat of the vessel, so that it can only be separated by force, and now begins to assume the appearance and character of flesh. After a time this organized structure, and the internal coat of the artery, grow completely together, and the danger of secondary hæmorrhage is precluded. When a ligature is applied to a vein, the coagulum is not formed in the proximal but in the distal side of the ligature: all the other changes (which are similar) take place more quickly than in the arteries.

It must be borne in mind that the application of the ligature, however dexterously the operation may have been performed, does not always prove efficient to the desired object, and the failure may depend either upon a want of constitutional power in the patient to form the plasma, or upon some physical condition which interferes with the formation of the clot. Indeed, as far as refers to the constitution of the patient, the same considerations would prevail here as in every other description of wound, but the surgeon must employ his scientific knowledge and judgment to obviate the physical difficulties that may present themselves. If after the application of a ligature to an artery, the clot should not be formed from either of the causes mentioned above, secondary hæmorrhage would necessarily occur; and perhaps no case can be brought under the notice of the surgeon which offers greater difficulties than the suppression of these hæmorrhages after the failure of a ligature. This fact was powerfully impressed on my mind at an early period of my professional career, in a case at Rotherhithe, in which I tied the external iliac artery of a gentleman. I experienced no difficulty in the operation, nor afterwards, until the twenty-second day, when I observed on dressing the wound a small fungus-like granulation surrounding the ligature: from this a drop or two of florid red blood issued upon the slight pressure of the plaster placed to support the cicatrix of the external wound, which had now quite healed, with the exception of the opening through which the end of the ligature protruded. The appearance of the wound about the ligature created great apprehension in my mind, and my fears were soon confirmed, for about twelve o'clock the same night, a messenger came for me, stating that a most alarming bleeding had taken place. I immediately accompanied him, but when I arrived the hæmorrhage had ceased. I found that the cicatrix had given way, and the whole wound was now filled with a large coagulum of blood. I immediately sent for my friend and then colleague, Mr. Green, who had been present at the operation, and on consultation we decided that turning out the clot of blood for the purpose of exposing the lacerated extremities of the artery would probably produce a gush of blood that would at once destroy the patient; and as several cases are recorded where, under similar circumstances, the effused clot had itself, by its pressure upon the artery, produced an inflammation sufficient to permanently seal the vessel, we determined to trust to the chance of this effect being produced. In this case, however, it failed; and the patient sunk from a recurrence of the bleeding. Upon a post-mortem examination, it was found that there had been no effort on the part of nature to close the vessel: not the slightest trace of clot was found either in the proximal or distal side of the ligature, which had come away at the first hæmorrhage; and when a probe was passed up the vessel, it could be distinctly seen shining through its attenuated coats. In this case the mischief evidently arose from want of constitutional power, and I afterwards ascertained that the individual was in the habit of indulging to great excess in the use of wine and brandy; but this was not at all indicated by his general appearance, and I treated him in the usual manner; but had I been acquainted with his habits, I should certainly not have wholly withheld his accustomed stimulus.

The precautions necessary in the application of a ligature upon a large artery to prevent the liability to secondary hæmorrhage from a physical cause, are—1stly, Not to place the ligature too near a large branch given off by the trunk to be tied; 2ndly, Not to disturb more than can be avoided the surrounding cellular connection of the vessel; 3rdly, To tie the ligature firmly, but not with a force sufficient to cut into the external coat of the artery, which would lead to the separation of the ligature before the adhesive process was sufficiently established; 4thly, To be careful in the mode of tying the knot in the ligature, so that it cannot loosen (that called the reef-knot is the best suited to the purpose); and, lastly, the surgeon should not interfere with the ligature to hasten its separation, but patiently leave it to nature. The period at which the separation occurs will differ according to the size of the artery, and the peculiar constitution of each patient. An interference on this point is the more reprehensible, as all the statistical accounts of secondary hæmorrhages prove that on their occurrence the danger is diminished in proportion to the length of time that has elapsed after the tying the artery, and that few prove fatal after the lapse of between thirty and forty days. Notwithstanding all these precautions, the application of a ligature may, however, prove abortive, in consequence of some abnormal distributions of the trunk upon which the ligature has been placed. This fact is well exemplified in a case, which will be detailed in a future lecture.

Application of ligatures.—When a ligature is to be applied to an artery for the purpose of staying a dangerous hæmorrhage, whether this bleeding results from the separation of a ligature previously applied for the cure of aneurism, from an incised wound in an artery, or in those cases where eight or ten days after amputation a secondary hæmorrhage results, it may be imrpudent to attempt to resecure the artery at the bleeding point, but much safer to cut down on the proximal side of the injury; thus avoiding the loss of blood at the point of lesion in the vessel during the progress of the operation, and securing the advantage of placing the ligature upon a sound part of the artery.

The application of a ligature upon a large artery, either for the purpose of checking hæmorrhage, or for the cure of aneurism, constitutes a most important surgical operation, requiring perhaps more anatomical knowledge than almost any other kind of operation: it is therefore proper to describe circumstantially the different steps to be followed in performing this operation upon the larger arteries: before doing so, however, I must introduce a few remarks upon compression as a cure for aneurism.

COMPRESSION IN ANEURISM.

This practice has particularly been revived in Dublin within the last few years, apparently with a degree of success that entitles the subject to the serious attention of surgeons. The use of compression in aneurism is founded upon observations made upon the method adopted by nature, where a spontaneous cure has been established—viz., the diminution of the quantity of blood flowing through the trunk of the diseased artery, the coagulation of the blood within the sac, and its consequent contraction, and the enlargement of the collateral bloodvessels to convey the blood to the parts below. The operation of compression consists in applying between the aneurismal sac and the heart a pad or compress, so arranged that the amount of pressure may be varied at the will of the operator, never being applied with sufficient force to completely arrest the flow of blood through the vessel, but merely to check its force: this being found sufficient to establish that tendency to coagulation necessary to cause obliteration of the sac. The idea of applying compression for the cure of aneurism appears to have originated, in the year 1680, with the Abbé Bourdelot, who having had the brachial artery of his right arm wounded, invented and applied a compressing instrument by which he ultimately effected a cure of the aneurism which had resulted. The instrument was termed a "ponton," and was formed of a pad with straps for the purpose of fastening it above and below the elbow. The first surgeon who employed compression for the cure of popliteal aneurism was Maltani, an Italian. His plan of treatment consisted in applying compresses over the tumour, and bandaging tightly the whole length of the thigh, keeping the bandage wetted with vinegar-and-water. This treatment in his hands seems to have been in every case attended by success, and upon it the more modern system of treatment by compression is founded.

The instrument used at the present time in compression resembles in the manner of its operation the tourniquet, but it has been constructed with numerous modifications. The greatest improvement in the modern application of compression consists in the use of two or more compressing instruments at the same time, so that when the pain becomes intolerable to the patient, which is often the case, instead of removing the whole apparatus, the pressure may be only transferred to another point in the course of the artery; and if two instruments be used, the pressure may thus be made alternately. And this appears to be quite an efficient method of applying the pressure: for, as I have before stated, the effect is produced, not by completely stopping the current of blood through the vessel, but by diminishing its force, which is sufficient to cause the deposition of fibrin in the sac, so that it shortly becomes quite filled up and destroyed. Compression is not intended to produce obliteration of the artery, but the destruction of the sac itself, the interruption of the circulation by the pressure causing an increase in the size of the anastomosing vessels sufficient to provide for the nourishment of the limb. The compression must be made where the artery is least deeply seated, and it must be made only at two opposite points of the limb, not comprehending the whole circumference, so that the collateral circulation may not be impeded, and the vessels left free to receive an additional quantity of blood. The pain in this operation is sometimes excessive, becoming, indeed, perfectly unbearable: it is said that the femoral and brachial arteries bear compression best, but the median nerve lying close to the brachial artery often renders its compression very painful.

Many years ago (about 1796) Sir Astley Cooper attempted to cure a popliteal aneurism by compression. The apparatus he employed was an iron ring with a cushion, which was placed on the outer side of the limb, and a screw with a pad so placed as to compress the artery at the will of the surgeon; but, to employ his own words, "the use of it was worse than the operation:" in a few hours after its application, the patient declared that he would submit to any operation rather than bear the excruciating and protracted pain. Sir Astley Cooper concludes his account of the case as follows:—"The plan of pressure on arteries does not succeed, and therefore ought to be abandoned."

I am inclined to believe, however, that Sir Astley Cooper committed the same error in the application of the compress, which I have myself fallen into—viz., that of considering it necessary to apply the pressure with sufficient force to stop the pulsation in the tumour; while, on the contrary, it only appears necessary that the current of the blood should be checked, which seems to tend much more to the coagulation of the blood than when its flow is wholly arrested.

A few months since I admitted a patient with popliteal aneurism into Guy's Hospital, and as I considered the case well fitted for compression, I sent to Dublin for Mr. Milliken's clamp-compressors, and applied the larger one in the upper third of the thigh, and the smaller one below, so as to compress the artery at the point where it pierces the tendon of the adductor magnus muscle, desiring the patient himself to adjust the pressure, and when it became intolerable in one point to transfer it to the other, by screwing down the second pad, and relaxing the first,—and thus to employ them alternately as the pain became excessive at either part.

The patient, however, notwithstanding the diminution of the tumour, and its evident increasing hardness, would not submit to a continuance of this protracted mode of cure, and begged of me to tie the artery, which I did, and he perfectly recovered.

My colleague, Mr. Cock, had a patient about the same time, on whom he tried the use of this instrument, but in his case also the patient would not submit to the pain produced by the instruments, and requested that the operation should be performed. It should be remarked, that in these cases the pressure was not applied with sufficient force to stop the circulation, but only to a degree sufficient to check the current.

In 1833 I admitted a patient into Guy's Hospital, with an aneurism in each popliteal region. The one on the left side was very small, and I therefore thought it a good case for compression. I tied the right femoral artery for the cure of the larger aneurism; and upon the smaller tumour on the left side, I applied a graduated compress, so as to fill the whole of the popliteal space. I then bandaged the whole of the lower extremity, commencing with the toes separately, with a view of modifying the flow of blood through the sac, the pressure on the sac being greater than on the rest of the limb. The bandage was adjusted three or four times in the period that the patient was confined to bed during the healing of the wound on the opposite side. On the eighteenth day the ligature came away; at the end of five weeks the wound had perfectly healed; and upon removing the compresses from the left limb, no other remains of the left aneurism existed than a small, hard, non-pulsating tumour: the patient was discharged cured; but in about six months after, he came back to the hospital, the aneurism on the left side having returned. I then tied the femoral artery, and he perfectly recovered.

I have not recited these cases with a view of condemning the application of compression as a cure for aneurism, for there is much too high authority for its efficacy to warrant any surgeon's condemnation of it; but still, as they occurred in my own practice, I consider it right to describe them. A good account of this plan of treatment, and numerous cases showing its favourable result, have been published by Dr. O'Bryen Bellingham, of Dublin.

Should the treatment of aneurism by compression be inapplicable, either from the position of the artery, or from the inability of the patient to sustain the continued pressure necessary to the cure, recourse must be had to the use of the ligature, for the purpose of at once cutting off the direct communication between the heart and the aneurism. I shall therefore proceed to describe the mode of applying a ligature to the most important arteries.

Operation of applying a ligature around the arteria innominata.—When aneurism occurs so close to the origin, either of the common carotid or subclavian arteries, as to render it impossible to apply a ligature to those vessels on the proximal side of the tumour, it becomes necessary to tie the arteria innominata; but before this operation is undertaken, the strictest investigation is required to ascertain that neither the innominata itself nor the arch of the aorta is the subject of disease. Nor is the diagnosis in such a case, easy; for in consequence of the interruption to the flow of blood through the carotid or subclavian arteries, an unnatural impulse is given to both the aorta and arteria innominata, which may be mistaken for aneurism of those vessels,—or should they be the seat of aneurism, the inordinate pulsation may be mistaken for the mere obstruction caused by the disease in the more distant vessels.

In illustration of this fact, I will relate the following case:—Mr. Allen Burn, many years ago, wrote to Sir Astley Cooper, to consult him as to the best mode of placing a ligature around the arteria innominata, as he had a patient who had aneurism of the subclavian artery, just as it sprung from the arteria innominata. Sir Astley Cooper, in answer, after describing the manner in which he should proceed in the operation, said, "But take care that the disease itself is not seated in the arteria innominata, or arch of the aorta." Mr. Burn was thus induced to carefully examine his patient, but could not positively decide in his own mind as to whether the arteria innominata itself was not diseased, and therefore did not perform the operation. The patient died about two months after, from hæmorrhage, and upon examination of the body it was found that both the aorta and the arteria innominata were diseased. There is at the present time a case in Guy's Hospital, under the care of Dr. Babington, in which there is great diversity of opinion as to whether the aneurism is situated in the subclavian only, or whether the innominata and arch of the aorta be also implicated in the lesion.

The arteria innominata was first tied by Dr. Mott, and has been tied five or six times subsequently, but in every case unsuccessfully. Mr. Liston, at the London University Hospital, preferred tying the origin of the carotid and subclavian in a case of aneurism of the latter vessel, in the hope of producing obliteration of the arteria innominata. Upon the separation of the ligature, however, hæmorrhage took place from the distal extremity of the divided arteries, and the patient died thirteen days after the operation.

From all the attempts to render the arteria innominata impervious having failed, it becomes a matter of doubt whether the operation can be considered admissible, as offering any just hope of lengthening life, and whether there is not at least as much chance of nature establishing a spontaneous cure as of a successful result attending this hazardous operation. As, however, under certain favourable conditions, it is possible that the operation may yet be considered advisable, I shall describe the mode of procedure I consider it best to adopt.

The patient should be laid on his back on a table, a hard pillow being placed beneath his neck and shoulders; the head being allowed to hang back so as to keep the anterior region of the neck on the stretch. An incision about two inches in length is made along the tracheal side of the right sterno-cleido-mastoideus muscle, terminating at its lower extremity just below the superior edge of the sternum. A second incision is then made transversely from the termination of the first outwards over the right sterno-clavicular articulation, and extending to the acromial edge of the clavicular origin of the sterno-cleido-mastoideus muscle. This incision is only to divide the skin and platysma myoides. The triangular flap of skin must now be turned back, and a large vein will then be seen running parallel with, and close to, the clavicle; this is to be drawn downwards, so that it may be avoided by the operator. The cellular membrane and fat must next be dissected from the clavicular origin of the sterno-cleido-mastoideus, which, as well as its tendinous sternal origin, is to be divided upon a director. The sterno-hyoidei and sterno-thyroidei muscles are now exposed: a director is to be passed from without to within, to ensure their safe division: the knife may now be laid aside, and with the assistance of a pair of forceps the deep fascia of the neck is to be scraped away with a silver knife or other convenient instrument, when the common carotid will be distinctly exposed, and is to be traced to its origin: more deeply seated, and to a certain extent hidden behind the carotid, the subclavian artery will be found. These vessels must be separately cleared from their fascial coverings, if it be the intention to put a ligature upon them for the purpose of obliterating the arteria innominata; but if it be the intention of the operator to place the ligature around the innominata, the aneurismal needle must be passed down behind the sternum, guided by the finger, so as to secure the application of the ligature at a sufficient distance from the origin of its terminal vessels. In passing the aneurismal needle in all these cases, it must be directed from below upwards, and from without to within.

Perhaps the most convenient instrument that can be used for passing the ligature is Dr. Mott's screw-needle: the surgeon should, however, always be furnished with several kinds of aneurismal needles, that he may be better prepared to meet the exigencies that may present themselves. It is remarkable that in all the cases in which the arteria innominata has been tied, death has arisen from hæmorrhage, and not in consequence of any functional disturbance produced by cutting off suddenly the supply of blood to the brain through the right carotid and subclavian arteries.

Operation of tying the carotid artery above the omo-hyoideus.—The patient should be placed in the recumbent position, with the neck extended and the head turned towards the opposite shoulder; an incision, about two inches and a half long, commencing an inch and a half below the angle of the lower jaw, is then made, continuing to half an inch below the inferior edge of the cricoid cartilage—occupying the mid space between the anterior edge of the sterno-mastoideus muscle on the outer side and the os hyoides and larynx on the inner; this first incision is to cut through the skin and platysma myoides, and expose the deep fascia of the neck, which is also to be divided to an equal extent, and in the same direction, taking care to avoid as much as possible the venous trunks that may cross the direction of the incision. The edges of the wound should be drawn asunder by broad retractors, when the carotid sheath is exposed; and usually the descending branch of the lingual nerve may be seen crossing the sheath from without to within, in the upper part of the exposed space. The sheath is now to be opened very cautiously, by raising a portion of it on the laryngeal side, with a pair of forceps, and a small opening being made, a silver director is to be introduced, by cutting upon which, the opening may be enlarged, for the purpose of laying bare the artery; this being effected, an aneurismal needle is passed beneath the vessel, being directed from without to within; the point of the needle is kept close to the artery, so as to avoid including the pneumo-gastric nerve. The needle is usually armed with the ligature before it is passed under the artery, but I think it is best to first pass the needle, as its passage is much easier without the silk, which may be introduced when the instrument is beneath the vessel. After this, nothing remains but the tightening and tying the ligature, having first carefully ascertained that the artery alone is included. When the ligature is secured, the edges of the wound are to be brought together, and maintained by one suture in the centre, and by strips of adhesive plaster. The patient being placed in bed, his head should be well supported, and maintained in such a position as to relax all the muscles of the neck. Much is said by surgeons of a difficulty arising in this operation, from the distention of the jugular vein, but I have three times tied the carotid artery without having in either instance even seen the vein;

indeed, I believe this may generally be prevented by making the opening into the sheath on its laryngeal side. Directions are also given to avoid the sympathetic nerve in passing the needle under the vessel, but as this nerve is not within the carotid sheath, but lies completely behind it, such a precaution seems to me unnecessary.

If it should become necessary, in removing a tumour, or from a wound near the angle of the jaw, to apply a ligature to the external carotid artery, the operation is performed in precisely the same manner as that last described, but should the vessel require to be tied nearer to the point at which it enters the parotid gland, the incision must be extended upwards and outwards towards the digastricus muscle, as the ligature must be placed around the artery just where it lies between the stylo-hyoideus and stylo-pharyngeus muscles.

When the carotid artery is tied below the omo-hyoideus.—The patient should, as in the last operation, be placed in the recumbent position—a position which I prefer, indeed, in all operations where it can be adopted, as in the sitting posture a fixed point is obtained for the full force of voluntary muscular action, while when lying, the patient is deprived of such *point d'appui*, and is therefore rendered comparatively helpless. The head and neck must be placed in much the same position as before described, but hardly so extended an incision is required; it should commence opposite the cricoid cartilage, and be continued downwards to within somewhat less than an inch of the sterno-clavicular articulation, taking the course of the inner edge of the sterno-mastoid muscle. The skin, platysma myoides, and superficial fascia, are divided by the incision, and the edge of the sterno-cleido-mastoideus exposed, along which a vein of considerable size is generally seen: this must be avoided; the muscle and the vein are to be drawn outwards, and the sterno-hyoideus and the sterno-thyroideus inwards, by means of retractors. At the upper extremity of the wound the omo-hyoideus muscle is seen crossing the vessels, and is connected by the deep cervical fascia to the sheath of the vessels; this fascia being divided below the muscle, the carotid sheath, with the lingual nerve lying on its inner side, is exposed; the sheath must then be opened, and the ligature passed around the artery in the manner before described. When this operation is performed upon the left side of the neck there is certainly some difficulty, from the comparatively superficial situation of the jugular vein, which partially covers the artery; extreme caution is therefore required to avoid injuring it.

Operation of tying the subclavian artery above the clavicle.—In this operation the patient is to be placed upon a table in the recumbent posture, and the shoulder on the diseased side forcibly pressed backwards, the arm being drawn downwards and held close to the side, for the purpose of depressing the clavicle. The skin is then to be drawn downwards tightly over the clavicle, and when thus stretched, an incision is to be made, commencing at the external edge of the mastoid muscle, and extending to the anterior margin of the trapezius; or if the latter should encroach so much upon the sterno-cleido-mastoideus muscle as to leave but a small space between them, some of the fibres of the trapezius must be cut through to give sufficient room: by this incision both the skin and platysma myoides must be divided. As the skin is tightly stretched when the incision is made, the moment it is divided the upper segment retracts, owing to its elasticity, and a wide opening is formed, exposing the loose cellular tissue beneath, as well as the external jugular vein, which will be seen lying close to the mastoid muscle. The next object in the operation is to expose the external edge of the scalenus anticus muscle, which is easily recognised from its glistening tendinous structure; to reach this muscle, the cellular tissue must be cleared away with the handle of the knife, deepening the wound parallel to the outer edge of the sterno-cleido-mastoideus, in the course of which muscle the skin may be further divided upwards if more room be required, and thus the object of search, the scalenus anticus muscle, may be brought into view. A deep triangular space is now exposed, of which the scalenus anticus forms the inner, the omo-hyoideus the outer, and the first rib the lower boundary, and it is in this triangle that the portion of the subclavian artery to be secured, is situated. The artery may be detected by pressing the finger upon the first rib, when its pulsations will be readily felt. With the finger-nail or a director, the cellular tissue, which ties the artery down to the rib, is now to be detached, and an aneurismal needle passed under the vessel, the point being directed from before backwards, and from below upwards, so as to avoid including the subclavian vein.

The operation is thus divided into three steps, in each of which certain specific difficulties may arise. In the first incision, the external jugular vein may be divided. To avoid this, the course of the vein should be accurately ascertained before the operation, that you may modify your incision accordingly. This accident happened to a surgeon in St. Petersburgh; the result was instantly fatal, from air rushing into the vein. In the second step, the object is to expose the scalenus anticus, which affords an infallible guide to the precise situation of the subclavian artery. In seeking the scalenus, which is indeed "the landmark" in the operation, care must be taken that its tendinous outer edge only is exposed; for if we work too much inwards—that is to say, under the mastoid muscle—we are likely to expose and injure the phrenic nerve which lies on the central part of the scalenus. Some years ago I performed this operation on a clergyman, in the presence of the late Dr. Babington and Mr. Travers: no difficulty whatever occurred in the course of the operation, but immediately afterwards the patient was seized with a constant hacking cough, as if resulting from convulsive motion of the diaphragm. This scarcely ceased night or day until the sixth day after the operation, when he died. No post-mortem examination was permitted; but there is no doubt in my mind but that the phrenic nerve had been injured, although it could not have been included in the ligature.

In the third step—viz., that of applying the ligature to the artery, the principal danger is the liability of including the first dorsal nerve, or taking it up instead of the vessel, to which it is placed in close contiguity, both above and to its outer side. I have seen this nerve tied instead of the artery by a most excellent surgeon, but the ligature was cut off again, and, the artery being secured, the patient recovered. A case is recorded where this accident happened, and in which the ligature was left upon the nerve; abscess in the brain followed, and the patient died. The subclavian vein can hardly be endangered during the application of the ligature, as it is much anterior to the artery, and from being separated from it by the scalenus anticus muscle. The precaution of passing the needle from before to behind is sufficient to protect this vessel from being included.

The operation of tying the subclavian artery in thin persons, and when the clavicle is not much raised by the aneurismal tumour, I have found comparatively easy; but in stout people, and where the clavicle is much elevated, it is perhaps the most difficult of surgical operations; in some cases, indeed, the difficulties have proved insuperable. Various ingenious mechanical contrivances have been invented for the purpose of seizing the ligature after the aneurismal needle has been passed under the artery, and indeed this is often by far the most perplexing part of the whole operation.

Sometimes the superior dorsal artery of the scapula is so much enlarged from obstruction to the flow of the blood through its natural channel, that it may be mistaken for the subclavian; but its superficial position would prevent an anatomist from making such a mistake. Care should be taken not to injure this vessel in the operation, as it constitutes one of the great sources of blood to the upper extremity after the subclavian is tied.

Operation of tying the subclavian artery below the clavicle.—It is in this region that, perhaps, under some circumstances, a ligature may be applied around the subclavian artery for axillary aneurism, instead of securing it above the clavicle, as I have already described. But I cannot see under what circumstances this operation can be preferred. I will, however, describe the method by which it may be performed. The patient is placed recumbent, and the shoulders somewhat raised by a pillow; the arm on the side of the disease is then brought to a right angle with the body, so as to put the pectoralis major muscle on the stretch; a hollow may then be felt between the upper edge of this muscle and the clavicular attachment of the deltoid; and in the centre of this hollow an incision is to be made three inches in length, commencing at the clavicular attachment of the pectoralis major, and being continued outwards nearly parallel with the clavicle; this incision should only divide the skin and the dense subcutaneous cellular tissue. After the incision is made, the arm is lowered to the side, when, from the relaxation of the muscles and skin, the wound may be widely opened, and should the sternal origin of the pectoralis major obstruct the further steps of the operation, its attachment to the clavicle may be partly divided and, as soon as the blood is sponged away, a strong shining fascia is seen at the bottom of the wound: it is termed the coraco-costal fascia, and is next to be divided with great caution, when the subclavian vein will be exposed. The vein is to be carefully separated from its fascial connexions, and on being gently drawn downwards, the subclavian artery itself will be seen. An aneurismal needle armed with a ligature may now be easily passed beneath the artery from below upwards, and the ligature secured.

Operation of tying the axillary artery.—In cases of aneurism either of the axillary itself or the upper part of the brachial artery, I do not conceive that any surgeon would recommend the application of a ligature upon the axillary, but would prefer to secure the subclavian artery above the clavicle. It may, however, appear to some that it might be advisable to tie the subclavian below the clavicle, but this operation is in itself much more difficult; and as there is no branch given off in the part of the vessel between the points selected for the upper and lower operation, there can be no reason why the more difficult operation of the two should be chosen. It might, however, from a wound in the axillary artery, be considered right to cut down upon it, and to apply a ligature above and below the opening.

Before the operation is undertaken, however, the precise part of the artery which is wounded should be ascertained, so as to decide whether it is in the upper or lower third that it ought to be secured: the middle third should never be selected for the application of the ligature, as the vessel is here completely surrounded by the brachial plexus. In the operation of tying the artery in the upper third, where it first takes the name of axillary, an incision is made very similar to that in the operation of tying the subclavian artery below the clavicle, commencing in the cleft between the sternal and clavicular portion of the pectoralis major, and being continued downwards and outwards to the axilla. If the arm be now adducted, the fibres of the pectoralis major may be easily separated, or, if necessary, may be divided, and the pectoralis minor will then be exposed: the superior edge of this is to be drawn down by a retractor, when a strong fascia will be seen. This is to be divided, when the artery will be seen lying beneath it, where it may be secured. This operation I cannot, however, conceive to be a safe one, or affording facility to the surgeon: unsafe, as, from the close vicinity of the cephalic and axillary veins, there is great danger of wounding them, and difficult, owing to the parts being very deeply seated, compared with the operation of tying the artery in the axilla. In the latter operation, the patient should be placed in the recumbent position, the arm being abducted and rotated outwards. The first incision is made, commencing about an inch behind the anterior edge of the pectoralis major, immediately opposite the head of the humerus, and about two inches or two inches and a half in length, according to the fulness of the parts. This incision should only penetrate the skin and subcutaneous cellular tissue; the aponeurosis of the arm must also be divided to an equal extent. When the skin and aponeurosis are thus divided, the edges of the wound must be separated, to expose the coraco-brachialis muscle, and the median nerve lying on the inner side of it: the nerve being exposed, it becomes easy to recognise the axillary artery at its posterior part, and here it may be tied without difficulty, as it can be easily reached and isolated, owing to the loose character of the cellular tissue in this region. The principal point to be attended to in the operation is to clearly recognise the coraco-brachialis muscle; for if you have not this guide, either the ulnar or the spiral nerves may be mistaken for the median, and the search for the artery prove ineffectual.

A patient was brought into Guy's Hospital some years ago, who, in falling down the hold of a barge, caught his arm in a hook which was fastened to the vessel's side. The biceps muscle in the upper third of the arm was lacerated, and severe contusion inflicted on the surrounding soft parts. There was some hæmorrhage at the period of his admission, but this was easily suppressed by a ligature applied to the bleeding vessel. The wound, in the course of a few days, assumed a sloughing aspect: nitric-acid lotion, with poultice, was applied, and tonics administered. This did not, however, check the sloughing, and in ten days severe secondary hæmorrhage occurred. I was immediately sent for, and proceeded at once to secure the axillary artery in the lower third of its course. This was easily effected, without removing the patient from his bed; and, in fact, he seemed to suffer more from the necessary forcible supination of the arm than from the operation. After the artery was secured, there was no further bleeding, and the patient quickly recovered.

Operation of tying the brachial artery.—The necessity for tying the brachial artery may arise either in consequence of its being itself wounded, or from lesions of the radial or ulnar branches; although generally, in the latter case, it is preferable, unless there be some cogent reasons against such a mode of procedure, to apply a tourniquet to the brachial artery, to cut down upon the wounded vessel itself, and to place a ligature both above and below the point of lesion; for if the ligature be only applied above the opening in the vessel, the free anastomosis between the radial and ulnar will be liable to lead to secondary hæmorrhage.

An aneurismal varix—that is, a communication between an artery and a vein, so frequently occurs in the operation of phlebotomy, as to be one of the most frequent causes of applying a ligature upon the brachial artery.

An aneurismal varix may, however, arise from disease as well as from accident, and not only between the brachial artery and a vein at the bend of the elbow (usually the median basilic), but between any artery and vein lying in close proximity.

An aneurismal varix, from whatever cause it may arise, may be recognised as a blue, circumscribed, pulsating tumour, lying in the course of a large arterial trunk. Upon auscultation, a distinct whizzing noise is heard at each systole of the heart; while a less distinct whizzing sound is distinguishable in the diastole when the tumour becomes comparatively flaccid. Pressure upon the artery above the tumour stops the pulsation, and the swelling becomes flaccid, but instantaneously re-fills when the pressure is removed. The swelling may be easily emptied by direct pressure upon it; the veins below the swelling are generally enlarged and tortuous, and the circulation through the artery impeded. The tumour rarely increases much in size, seldom exceeding that of a small walnut, unless much exertion is employed, to which generally the patient has great intolerance, in consequence of the weakness of the limb, attended with more or less pain—inseparable concomitants of this condition.

The most frequent cause of aneurismal varix is the transfixing the vein and wounding the artery behind it in the operation of phlebotomy. This accident is immediately indicated by a profuse rush of arterial blood gushing per saltum through the wound. The removal of the ligature placed on the upper arm preparatory to venesection does not check the bleeding, which can only be staid by compression made upon the wound by dossils of lint maintained in their position by bandages. I do not myself, however, consider this a good plan of procedure, as, in order to stop the bleeding, the bandage must be applied sufficiently tight to impede the circulation in the lower part of the limb, which causes swelling and pain, so that it is generally necessary to remove the bandage, when hæmorrhage will be certain to recur. It is better, in my opinion, to apply a graduated bandage along the whole of the arm, commencing at the ends of the fingers separately, and continuing it up to the shoulder, placing at the same time a compress upon the middle portion of the brachial artery with sufficient firmness to check, without stopping, the arterial current. Under these circumstances a tendency to coagulation of the blood is set up, and is further promoted by the patient being kept in the recumbent posture, with the arm elevated on a pillow, and kept constantly wet with cold water.

About four years ago, a young surgeon of my acquaintance, in bleeding a patient in whom the vein was immediately over the artery, opened the vessel with such precaution, that a friend who was present at the operation said to him, "You'll never get half blood enough from that opening," and, taking the lancet from him, made a second puncture, upon which arterial blood gushed forth with great violence. The cautious operator immediately compressed the opening, but found it extremely difficult to prevent the flow of blood until the brachial artery was well compressed above. He then proceeded to bandage up the whole arm, commencing with the fingers separately, and filling up the bend of the elbow with lint, particularly placing a dossil of that substance over the wound, and, at the same time, placing a second compress on the middle of the brachial artery, to retard the flow of blood through that vessel. Under this treatment, the wound through the vein and artery perfectly healed, and this took place apparently without the obliteration of either vessel, as the pulsation was afterwards as distinct as is natural at the wrist, and the superficial veins retained their normal appearance. If this mode of compression fails, the communication between the artery and vein remaining permanent, the wound through the skin only having healed, an aneurismal varix is established, and will require further surgical treatment for its cure. Sir Astley Cooper, in speaking of aneurismal varix, says, "that no surgical operation is generally required in this disease, as it is not dangerous either to life or to the arm." Such may be the fact to those who have no necessity for the violent exertion of the limb; but to a poor man who has to gain his bread by his own exertions, such a limb would be totally incompetent, not only from its weakness, but from the danger arising from the tumour being exposed to external injury. There are two modes by which this abnormal condition may be removed—viz., either by tying the brachial artery in the middle of the upper arm, or by laying open the aneurismal sac, and tying the artery above and below the point of lesion. If the first operation be chosen, it may easily be effected by making an incision through the skin, two inches and a half in length, in the middle of the upper arm, on the inner side of the biceps muscle—thus exposing the fascia of the arm, which is to be laid open to the same extent, when the biceps is brought into view, and is to be drawn outwards. The median nerve, brachial artery, and venæ comites, are now exposed; the artery is to be separated from the nerve and veins, and, a ligature being passed around it, it may be secured in the usual manner. This operation does not, however, always succeed, in consequence of the free recurrent anastomosis between the radial, ulnar, interosseal, and inferior branches of the brachial arteries. I nevertheless believe that this operation would rarely fail if due precaution were taken to apply gentle compression on the fore-arm, as before described, in addition to the ligature applied to the brachial artery.

Should the aneurismal varix, however, prove incurable by these means, the following operation may be had recourse to:—A tourniquet is placed upon the brachial artery, so as completely to compress it, and a free incision is made into the aneurismal sac, which is to be completely emptied of its clot, and the interior cleansed by a sponge: the upper and lower opening of the artery into the sac is then to be sought for, and a probe passed first into the upper opening, to serve as a guide in separating the artery from the surrounding tissues; after which the vessel is to be secured. The same process is to be repeated upon the distal end. This operation is frequently followed by violent constitutional irritation, and more so than the former operation, although it must be admitted that, as far as refers to the cure of the varix, it is generally successful. The danger in this mode of proceeding seems to depend upon the numerous branches of cutaneous nerves which are distributed at the bend of the elbow, and which can scarcely escape injury during the progress of the operation. But I have, however, myself performed it, as have likewise my colleagues Mr. Cock and Mr. Hilton, with a successful result.

LECTURE LX.

CONTINUATION OF THE DISEASES AND INJURIES OF THE VASCULAR SYSTEM.

Varicose aneurism—How formed—Difficult of diagnosis—Case—Tying radial artery—Steps of the operation—Tying the ulnar artery—Precautions necessary in these operations—Aneurism of the abdominal aorta—Sir Astley Cooper's operation of tying the abdominal aorta—Case—Description of the operation—Post-mortem examination—Tying the common iliac artery—Steps of the operation—Tying the internal iliac—The operation—Tying the external iliac—Sir Astley Cooper's operation—Difficulties attendant upon it—Modification of the operation—Cases.

Varicose aneurism is a term employed when an aneurism opens into a vein more or less distant from the artery, the communication being formed by ulceration and not by puncture. The effect produced is, however, very similar to that in traumatic aneurismal varix: a similar pulsating tumour is formed, thrilling at each systole of the heart, and the phenomena are so identical, that it is only from the history of the case that the cause of the communication between the vessels can be ascertained. The following case very well illustrates the nature of the disease:—

T. T., aged 24, was admitted into the Shrewsbury Infirmary, in April 1839, with a pulsating tumour over the internal malleolus of the left leg, extending about three inches upwards, and placed midway between the anterior spine of the tibia and the tendo-Achillis. A thrilling sensation could be felt through the whole course of the saphena major vein, as far as the upper part of the thigh; pressure upon the posterior tibial artery did not stop the pulsation, but if made upon the popliteal, or femoral artery, it was readily commanded. The patient stated that the disease commenced about five months before his admission into the Infirmary, and that he was at once disabled from following his usual occupation. From the strumous diathesis of the patient it seemed probable that a slow ulcerative process had established the communication between the artery and the vein. A consultation being held on this case, the surgeons of the Infirmary, with the exception of the gentleman under whose care the patient was placed, were of opinion that a ligature should be applied around the femoral artery: this system of treatment was not, however, followed, but the limb was amputated.

No subsequent history of this case has been published.

The radial or ulnar artery may either of them require ligature for the cure of traumatic aneurism, or to check the hæmorrhage in case of their being wounded in the fore-arm or in their palmar branches. It is in wounds of the palm of the hand that these operations are most frequently required, and in consequence of the very free anastomoses between these two vessels in the depth of the hand, perhaps there is no case of bleeding more perplexing to the surgeon, or more difficult to control, than wounds of the palmar arteries. When a punctured wound, for instance, has occurred in the deep palmar arch, which is generally caused by a fall on the palm of the hand, there is not only an immediate extravasation of blood, but violent sub-fascial inflammation quickly supervenes, and this, added to the intricate deep-seated structure of the parts, renders it impossible to cut down upon the wounded vessel for the purpose of placing a ligature on either side of the opening. Some years ago, my late colleague, Mr. Callaway, was called to a case of this kind, and finding that pressure on the radial artery stopped the hæmorrhage, he tied that artery about an inch above the wrist; the bleeding recurred in a few hours, and he then tied the ulnar artery, but on the third day hæmorrhage from the original wound again took place; the interosseal artery was next secured, when the hæmorrhage was permanently stopped; but this was followed by sloughing of the parts, so that amputation of the hand became necessary. The treatment which I should follow in wounds of the palmar arteries, if in the superficial palmar arch, would be to enlarge the wound, and to secure the bleeding vessel; but if in the deep arch, I consider that mode of proceeding impossible, and should try the effect of bandaging, in the manner already described, commencing at the fingers individually, and *gently* compressing the radial and ulnar arteries with pieces of cork; should this not succeed, I should tie the brachial artery, with the view of directing the current of the blood from its usual course, leaving the circulation of the fore-arm and hand to collateral branches: this appears to me to be a much more likely means of stopping the bleeding than by tying either the radial or ulnar arteries near the point of injury. Attention must, however, be paid to the position of the limb, the application of cold, and the diet of the patient. I was lately called to a case of sloughing of the hand, in which there was profuse hæmorrhage from the principal artery of the thumb, where it is deeply seated between the adductor pollicis and the adductor indicis muscles. Although in this case the bleeding was profuse, I could not discover its precise source, but I passed a crooked needle, armed with a ligature, deeply down by the first phalanx of the thumb, along the under surface of the adductor muscle, and the tightening of this ligature completely checked the hæmorrhage, which did not afterwards recur. The radial artery may be tied in any part of its course from the bend of the elbow to the point where it becomes palmar: but the operation is much more difficult in the upper third of the fore-arm than in any other part.

Operation of tying the radial artery.—If it be necessary to secure the artery in the upper third of its course, an incision must be made commencing an inch below the bend of the elbow, a little to the radial side of the middle of the fore-arm, and continued obliquely downwards, and slightly outwards, for two inches and a half; this incision should merely divide the skin, avoiding as much as possible the superficial veins: the fascia is next to be divided to the same extent, and this second incision exposes the inner or ulnar edge of the supinator radii longus muscle, which is to be drawn outwards, when the deep fascia of the arm will be exposed, and is next to be divided; the radial artery will now be brought into view, with the radial nerve on its outer side: and the ligature may be applied in the usual manner. If it be considered advisable to tie the artery in the middle of the fore-arm, it is easily exposed by an operation precisely similar in all its stages to that just described, excepting that the incision is to be commenced where the last is said to have terminated.

From the superficial position of the radial artery at the inferior third of the fore-arm, it is frequently exposed to injuries which render the application of a ligature necessary to stop the bleeding. To expose the vessel in this part, an incision, two inches and a half in length, is to be made on the radial side of the tendon of the flexor carpi radialis muscle: this incision is to expose the fascia, upon the division of which the artery may be seen, with its nerve on the radial side, so that the artery is placed between the tendon and the nerve.

Operation of tying the ulnar artery.—The ulnar artery, in taking its course from the elbow to the hand, differs from the radial in being more deeply seated in the upper third of the arm, and superficially in the hand, while the radial is comparatively superficial above, and deeply placed at its termination. Therefore, to tie the ulnar at the commencement of its course is a much more difficult operation than to secure the radial in the same situation. It may, however, be effected in the following manner:—The arm being supinated and resting on a table, an incision is to be made two inches below the internal condyle of the humerus, and continued downwards for three inches in the course of the centre of the ulna; the fascia being laid bare, it is to be divided to the same extent, and an intermuscular space between the flexor sublimis and flexor profundus will be exposed. The elbow must now be flexed, which will relax these muscles and permit of their separation to a sufficient degree to expose the artery, around which the ligature is to be applied. The necessity for this operation must be very rare, for, in consequence of the depth of the vessel, it is but little subject to lesion; and if a wound should be inflicted in it below this, it is better to tie the vessel at the point of injury than to attempt the difficult operation now described.

In the inferior third of the fore-arm the ulnar artery is readily exposed by making an incision about two inches and a half long on the radial side of the flexor carpi ulnaris: the fascia being divided, this muscle is exposed, and is now to be drawn inwards; the deep fascia is next to be laid open, when the artery will be exposed, lying on the radial side of the ulnar nerve; from this, as well as its veins, it must be separated, when the ligature can easily be passed around it.

In the description I have given of tying the radial and ulnar arteries, I have perhaps hardly sufficiently explained how much the successful performance of these operations depends upon clearly exposing the superficial and deep fasciæ of the fore-arm; for instance, immediately under the skin the superficial fascia is found: upon cutting through this, and by the separation of the muscles or tendons, without the aid of a knife, the deep fascia is brought into view, and it is not until this is divided that these arteries can possibly be exposed; and if this deep fascia were unintentionally cut through at the first incision, the distinctive steps of the operation would be lost, and the operator become confused by the absence of any guide, and could not be certain whether it were the deep-seated or superficial muscles which were exposed.

Having completed the surgery relating to the arteries distributed from the commencement of the aorta, I shall now proceed to the consideration of those vessels which supply the lower extremities, and are derived from the termination of that great systemic trunk.

Circumstances might indeed occur which would warrant the repetition of Sir Astley Cooper's bold, and most scientific attempt to save the life of a person, from a bleeding which threatened to be fatal, by the application of a ligature to the aorta itself; and in a case where, from the bursting of an aneurism, no other means could be had recourse to, I should not hesitate to follow his example: but in the case of a wound of the iliac artery, which, having been temporarily closed by a coagulum, afterwards bled afresh, I do not think the application of a ligature to the aorta so likely to prove effectual, as the collateral branches could not have been in the same manner prepared to convey the blood.

The following is an account of the case in which Sir Astley Cooper tied the abdominal aorta:—Charles Hudson, a porter, aged thirty-eight, was admitted into Guy's Hospital, April 1817, with an aneurism of the left external iliac artery. On the third day after his admission, the swelling suddenly increased to double its former size, and distinct fluctuation could be felt above Poupart's ligament. The tumour now filled the space between the thigh and the reflexion of the peritoneum, so that any attempt to expose the iliac artery would probably have led at once to a fatal hæmorrhage. Sir Astley Cooper ordered the patient to be bled, to be kept perfectly quiet, and pressure to be applied to the tumour. A slough soon formed upon the surface of the skin, but the patient remained for sixteen days without bleeding. On the morning of the seventeenth day, however, a profuse hæmorrhage occurred, which so exhausted him that he passed his fæces involuntarily. Sir Astley Cooper was immediately sent for; and as he saw that a return of the bleeding would destroy the patient, he determined upon placing a ligature around the aorta. The operation was performed as follows:—The shoulders of the patient were raised by pillows, for the purpose of relaxing the abdominal muscles, and an incision was made three inches long, half of which was above and half below the umbilicus, but curved so as to avoid that part: the linea alba was thus exposed, and was next divided. A small aperture was then made into the peritoneum, and enlarged by a probe-pointed bistoury to nearly the size of the external wound. At this stage of the operation a small convolution of intestine projected, but it was easily returned. Sir Astley then passed his fore-finger between the intestines to the spine, and readily felt the aorta beating with great force. By means of his finger-nail he scratched through the peritoneum at the left side of the vessel, and, gradually insinuating his finger between it and the spine, penetrated the peritoneum on the opposite side: through the opening thus made he passed the aneurismal needle, armed with a single silk, which Mr. Key, who was assisting him, drew from the eye of the needle to the external wound. There was some difficulty in tightening the ligature without including a portion of intestine; but this was ultimately effected: and for the first time the aorta of a living man was enclosed within a ligature.

Immediately after the operation the patient again passed his fæces involuntarily. The edges of the wound were brought together, and maintained in apposition by quill suture and adhesive plaister. The patient was put to bed; his pulse was upwards of a hundred and forty. Upon touching the thigh the man thought that it was his foot that was pressed—showing that the sensibility of the limb had become imperfect. The patient remained comfortable until the following evening, when he vomited, and his fæces again passed from him involuntarily. He passed a restless night, and vomited at intervals: his pulse was 104, weak and small; his countenance was anxious; he complained of pain in his head, and his urine kept dribbling from him. He gradually became weaker and weaker, and died forty hours after the operation.

Upon a post-mortem examination, no sign of peritoneal inflammation was found, but adhesive matter had glued together the edges of the wound. The ligature had been passed around the aorta about three-quarters of an inch above its bifurcation, and more than an inch below where it is crossed by the duodenum: neither intestine nor omentum had been included in the ligature. On laying open the aorta, a clot of more than an inch in length was found to have sealed the artery above the ligature, and both common iliacs were also closed to the extent of an inch by the continuation of a clot which had formed in the aorta below the point of compression—a condition which proved that the aorta itself is as competent as smaller vessels to become obliterated by the application of a ligature.

The aneurismal sac was of enormous size, and reached from the common iliac artery to Poupart's ligament, encroaching on the outer side of the thigh.

This case, notwithstanding its unsuccessful result, seems to my mind to establish the propriety of a repetition of the operation under favourable circumstances. I attribute the death of Sir Astley Cooper's patient to the quantity of blood lost on the first giving way of the slough: for it is stated that he then passed his fæces involuntarily, which is the strongest possible indication of prostrated vital power.

Sir Astley Cooper says, in a note in his second volume of Surgical Lectures, p. 72, (edited by Mr. Tyrrell,) "in an operation which I lately performed, of tying the external iliac artery above Poupart's ligament, I think I could with little difficulty have reached the aorta by turning up the peritoneum: and should I again think it advisable to place a ligature on the aorta, I should prefer this method to the one I before adopted." I doubt, however, whether Sir Astley Cooper would have succeeded in his case, unless he had performed the operation on the right side of the abdomen, and this would have complicated the steps, as he would have had to cross the inferior vena cava to reach the aorta; for, had he made his section on the left side, not only would the aneurismal sac have limited his space, but there would have been great danger of hæmorrhage as soon as he had divided the parietes of the abdomen. Moreover, it has now been sufficiently proved that there is not that danger in opening the peritoneal cavity in health, which was at one time so much dreaded by surgeons: I should, therefore, in an attenuated patient, proceed in the manner followed by Sir Astley Cooper, in the case already described.

Operation of tying the common iliac artery.—The common iliac arteries do not send off any branches of importance in their course from the space between the fourth and fifth lumbar vertebræ to the sacro-iliac symphyses, where they divide into the internal and external branches. These arteries are but little subject to disease, and I believe there are no instances on record in which a ligature has been passed around them, except for the cure of aneurism of some more distant branch. I have never myself performed this operation, but once saw it done by Mr. Guthrie.

The operation is performed in the following manner:—The patient is placed on a table, with the shoulders slightly raised and supported by pillows, and the thigh on the diseased side elevated for the purpose of relaxing the abdominal muscles. An incision is made, commencing an inch above the anterior and superior spinous process of the ilium, and continued downwards to the internal abdominal ring, keeping it parallel to the curve of the ilium, and in the direction of Poupart's ligament. This first incision is only intended to divide the skin and superficial fascia: the edges of the wound are now to be separated, when the tendon of the external abdominal oblique muscle will be seen, and must be divided, the opening being made of equal size with the external incision, and as much of the oblique muscle itself as may be exposed, is also to be cut through. A director is next to be passed beneath the free edges of the internal oblique and transversalis muscles, great care being taken in this step not to puncture the fascia transversalis by the director, the muscles are to be divided, by which means the fascia transversalis, or internal abdominal fascia, will be completely exposed: this fascia is now to be cautiously opened to the same extent as the first incision, when by passing the fingers into the wound, the peritoneum can be readily separated from the iliac fossa. These steps being completed, the peritoneum must be separated from the fascia iliaca by insinuating the fingers between them; and if the hand be now directed towards the sacro-iliac symphysis, the division of the common iliac into the internal and external branches may be distinctly felt; and as the common trunk is in this region only loosely connected with the psoas muscle, the aneurismal needle, conducted by the forefinger, may be readily passed behind it.

The most difficult step in this operation is raising the peritoneal bag and its contents, to obtain sufficient room to tie the artery, without endangering the peritoneum. This is best effected by an assistant standing on the opposite side of the patient from the operator, and drawing the viscera carefully towards himself, by placing his hand beneath the bag of the peritoneum. In passing the ligature in this operation, great care must be taken that the ureter be not included within it; and as that canal passes in front of the iliac vessels, it should be raised, with the peritoneum, by the assistant. Such are the steps of the operation by which (in the opinion of Sir Astley Cooper) the aorta might be more easily reached than by those which he adopted in the case of tying that vessel, as already described.

Some surgeons have recommended another mode of proceeding in tying the common iliac artery—viz. first to make an incision through the skin of the abdomen parallel to the epigastric artery. This incision is to commence about an inch above the centre of Poupart's ligament, and be continued upwards for four inches, terminating at the outer edge of the rectus muscle, so as to expose the tendon of the external abdominal oblique. This tendon is to be divided: the three layers of abdominal muscles are then to be cautiously cut through, and an opening made in the fascia transversalis by the finger-nail, so that the cavity of the abdomen may be entered; the peritoneum is then to be detached from the iliac fossa, in the same manner as I have described above, and the vessel secured.

I consider this last operation much more difficult than the former, because the operator would be certain to divide large branches from the epigastric artery, the bleeding from which would interfere materially with the further steps of the operation; 2ndly, in consequence of the extreme tenuity of the internal abdominal fascia towards the mesian line, compared with that in the iliac region; and 3rdly, because in the proposed vertical incision the spermatic vessels would be much more likely to be wounded.

Operation of tying the internal iliac artery.—Dr. Stevens, of the island of Santa Cruz, was the first who placed a ligature around the internal iliac artery. The operation proved successful; and perhaps, from the length of its course before it divides, and the numerous branches which it then sends off, which all freely anastomose with the artery on the opposite side, there is scarcely any artery in the body which affords a greater probability of a successful termination to the operation; but still it must be admitted that it is one of the most difficult to reach, owing to the depth of its situation, its near approach to the mesian line, and its close proximity to its corresponding vein, external iliac artery, and the ureter. Had I to tie this artery,—an operation I have never performed,—I should proceed exactly in the same manner as in the operation of tying the common iliac. An advantage may perhaps be gained as to the ease with which the artery can be reached after the incision has been made, by remembering that the origin of the internal iliac is in the centre of a line drawn from the anterior and superior spinous process of the ilium to the umbilicus. Even in the dead subject, I have found this operation very difficult, for in the force necessary to hold the mass of intestines back, there is great danger of wounding the peritoneum; and if a large opening be made through that membrane, the difficulties in the further course of the operation would be almost insuperable.

Operation of tying the external iliac artery.—In the operation of tying the external iliac artery, either the vertical, or oblique lateral incision may be employed: the former was first recommended by Mr. Abernethy; the latter is generally known as "Sir Astley Cooper's operation." For the reasons already given, I prefer the incision made in the course of the tendinous fibres of the external oblique muscle, to that made vertically through the parietes of the abdomen; and having performed this operation on nine occasions, I can speak confidently of the facilities in the lateral method.

In the first case in which I tied this artery, I commenced the incision about two inches on the inner side of the anterior and superior spinous process of the ilium, and continued it downwards and inwards, terminating in the space between the internal ring and the spinous process of the pubes.

This incision followed, therefore, the course of the spermatic chord after it issued from the internal ring, and merely divided the skin and superficial fascia. The tendon of the external abdominal oblique muscle was next divided, and the inguinal canal consequently laid open. I now laid hold of the chord, and turning up the free edges of the internal oblique and transversalis muscles, exposed the spermatic chord at its point of exit from the cavity of the abdomen, the orifice being, however, concealed by the fascia spermatica interna. This fascia, which is, indeed, only an extension of the internal abdominal fascia, was cautiously torn through by the finger-nail, and the opening enlarged by a bistoury, introduced upon a director. The finger was now directed deeply downwards and inwards towards the linea ileo pectinea, where the artery was readily felt; and the spermatic chord being drawn and held upwards and inwards by an assistant, the artery was easily separated from its vein by means of the finger-nail, and the aneurismal needle with a ligature passed behind it, being directed from within to without. In three or four of my early cases I met with considerable difficulty in ascertaining when I had reached the peritoneum through the internal abdominal fascia; for, in consequence of the prolongation of the former along the chord, these two delicate membranes lie in such close contiguity as to render their separation extremely difficult. In this mode of operating, the spermatic chord also tends much to limit the space required in securing the artery: I have therefore latterly adopted a modification of the operation, and instead of extending the first incision beyond the internal ring in the course of the inguinal canal, I stopped at the ring, and then cut through the tendon of the external abdominal oblique muscle, so as to expose the attachment of the internal, oblique, and transversalis muscles, to Poupart's ligament. After dividing the attachment of these muscles, they are to be turned up, when the internal abdominal fascia, which is in this situation strongly developed, will be brought into view, and in consequence of its great tenacity offers none of those difficulties which are experienced, when the opening through it is made on the inner side of the internal abdominal ring. The fascia when divided is here so perfectly free from adhesion to the peritoneum, that the operator possesses great facility in elevating the peritoneum and enclosed viscera from the iliac fossa, and in reaching the external iliac artery. In the performance of the operation last described, I have been able completely to expose the artery before applying the ligature; while in the method I first adopted, I never dared sufficiently to separate the peritoneum from its attachment to the fascia, to enable me to see the artery whilst I passed the ligature around it. I have already described a case in which I secured this artery, when speaking of the process by which an artery is obliterated by a ligature; but in that case I did not succeed, as no coagulum formed, and upon separation of the ligature fatal hæmorrhage ensued.

In 1827, Feb. 20th, I performed the operation of securing the femoral artery for popliteal aneurism, on Richard Robins, an agricultural labourer, æt. 36. There was nothing particular in the operation, and he appeared to be going on favourably until the sixth day, when the wound put on an erysipelatous inflammation: this was treated in the usual manner, and easily subdued. On the eleventh day after the operation, a severe hæmorrhage occurred, but was restrained by pressure: it recurred, however, in the course of the day, when I was sent for, and immediately tied the external iliac artery. All hæmorrhage ceased, and the patient appeared to be going on remarkably well, until the 8th of March, when he was attacked with vomiting and symptoms of great depression; the vomiting continued at intervals throughout the night: the countenance was anxious; pulse quick and feeble, and the sickness continued in the most distressing manner, unrelieved by any remedies that were administered; and on the seventh day after the application of the ligature to the external iliac artery, the patient died. The friends would not allow the body to be examined. But the death of this patient appeared to result rather from the great depression caused by the original loss of blood, than from any circumstance attributable to the second operation.

In January, 1823, a poor man called to obtain the advice of Sir Astley Cooper, who at that time saw a great number of patients gratuitously. He was the subject of an aneurism of the femoral artery, opposite to the point where that vessel perforates the adductor magnus. Sir Astley placed the patient under my care, and as at this time I had not been appointed surgeon to Guy's Hospital, I placed him in private lodgings. On examining the case, I found the artery diseased just below Poupart's ligament, and therefore could not, as I intended, apply the ligature upon the superficial femoral artery; I consequently determined upon tying the external iliac. I performed the operation by laying open the inguinal canal; entering the abdomen by tearing through the prolongation of the internal abdominal fascia on the chord, I found considerable difficulty in raising the peritoneum, but succeeded, however, in placing a ligature round the artery. On the twenty-first day the ligature came away, and the wound healed favourably. Sloughing of the foot ultimately supervened, but after removing the two outer metatarsal bones the patient perfectly recovered.

Hans Jacobs, æt. 44, a Danish sailor, was admitted into Guy's Hospital on the 16th of July, 1831, with a large aneurism a little below Poupart's ligament, over which the swelling partly extended. The lateral dimensions of the tumour exceeded the vertical: it was more solid at its outer part than in the centre; the pulsation was extremely strong. On the 19th I placed a ligature around the external iliac artery, and in this case I made my first incision so as to cross the internal ring; in securing the artery through the ring, I experienced the same difficulty I have already mentioned, in raising the peritoneum. The temperature of the limb was, on the day after the operation, a degree and a half higher than that of the opposite leg. On the 21st the ligature came away, and shortly after the patient was discharged quite well, the wound healing by granulation.

George Sullivan, æt. 34, by profession a flute-player, of cachectic appearance, from the irregular habits of living almost inseparable from his occupation as a tavern musician. He described that about a month before his admission into the hospital (on August 29, 1836), he accidentally discovered a pulsating tumour about the centre of the middle third of the right thigh, just in the tract of the femoral artery. He could not attribute it to any accident or violent exertion. The tumour was about the size of a large hen's egg, and was easily emptied either by pressure upon it, or upon the artery above, but it instantaneously refilled upon the pressure being removed. A few days after his admission, I tied the external iliac artery, pursuing the same course in the operation as I have described in the other cases. On the day following the operation the limb was a degree higher in temperature than that on the healthy side, and the patient was perfectly free from pain. The next day he had rather a sharp attack of fever, attended by vomiting, and considerable pain in the wound. The bowels not having been opened, he was ordered saline draughts. This treatment was sufficient to relieve the febrile symptoms, and no further untoward circumstances occurred. On the eighteenth day after the operation the ligature came away, and from that moment the patient rapidly recovered, and was discharged on October 11, quite well.

In 1838, I witnessed the operation of tying the external iliac artery by my late colleague, Mr. Morgan; the operation was rendered unusually difficult, from the presence of hernia on both sides. The man was the subject of an aneurismal tumour of the right femoral artery at its division into the superficial and deep branches. On the 10th of October, Mr. Morgan tied the right external iliac, making an incision extending from an inch below the anterior and superior spinous process of the ileum to within an inch of the spine of the pubes. On dividing the tendon of the external abdominal oblique muscle, the right inguinal hernia immediately protruded, rendering the operation extremely difficult: it was a difficulty, however, which the operator, by his great coolness and precision, immediately overcame, and the patient recovered without an untoward symptom.

John Bryant, æt. 41, was admitted into the hospital, Feb. 14, 1844, with a double aneurism of the right femoral artery, the sacs being about two inches distant from each other, and about four inches below Poupart's ligament. The patient was short, stout, and carried an appearance of recklessness in his countenance. On the 20th of February I tied the external iliac artery. From the stoutness of the patient I met with more than usual difficulty in exposing the vessel, which presented a diseased appearance, it being larger and its coats thinner than natural,—creating a fear in my mind, when I tightened the ligature, that they might possibly give way, from the constriction; nothing untoward, however, occurred. The next day the patient complained of general abdominal tenderness, attended by nausea. His countenance was anxious, and pulse small and hard. Calomel and opium were ordered, and a light poultice over the abdomen. On the 22nd the patient had in no respect improved. The abdomen was distended, and the bowels constipated: indeed the symptoms were so urgent and peculiar that a suspicion crossed my mind that I might possibly have included a portion of intestine within the ligature. My fears proved, however, unfounded: for the administration of half an ounce of castor oil and fifteen drops of laudanum produced a copious healthy motion. On the 18th of March, twenty-six days after the operation, the ligature came away without the slightest bleeding, and the patient remained for a week in such a state as to lead to the hope of rapid convalescence. On the 29th of March, however, signs of gangrene appeared in the little toe, and, notwithstanding medical treatment, continued to progress until the whole foot was in a state of sphacelus. On the 4th of April the gangrene had extended above the ankle, the general health of the patient being, however, but little affected. By the 12th, more than half the leg was in a state of gangrene, emitting a most offensive effluvium, and his constitution then began to suffer from the local affection. Brandy, bark, ammonia, and animal food, were ordered, and on the 18th a distinct line of demarcation had formed about two inches below the tubercle of the tibia. The health of the patient was now much improved, and on the 21st I considered him in a fit condition to bear amputation of the limb. He immediately consented to it, and after the operation the stump readily healed by granulation, and he left the hospital quite well on the 18th of July.

Henry Stevens, æt. 51, a healthy-looking man, of spare habit, was admitted into the hospital, 4th August, 1845, with aneurism of the right femoral artery: he attributed the commencement of the disease to stumbling over a stone when carrying a heavy load, a few months before. When admitted to the hospital, the tumour was raised about two inches above the level of the thigh, was five inches in diameter, and occupied entirely the triangular space formed by the sartorius, obturator muscles and Poupart's ligament: the latter it partly overlapped. The pulsation was very strong, and the whizzing sound loud upon auscultation. The arterial system generally, as well as the lungs, was pronounced healthy. Owing to the patient being somewhat out of health when admitted into the hospital, he was not operated on until the 14th inst. In this case I changed my plan in the operation, making the incision to terminate entirely on the outer side of the internal abdominal ring, and instead of turning up the free edges of the internal oblique and transversalis muscles, I cut through their attachments, to Poupart's ligament, and thus only exposed the iliac portion of the internal abdominal fascia; on the division of this I easily separated the peritoneum from the iliac fosa, and brought the artery distinctly into view: scarcely any blood was lost in the operation. The patient was removed to bed, and the limb, slightly flexed, was wholly enveloped in flannel: eight hours after the operation the temperature of the limb had risen to 99°, while that of the sound limb was 97°; on the following day, the temperature on the side of the disease had increased to 102°, that of the other side being 101°.

From this time until the 1st of September, the patient did not present any alarming symptoms, although his general constitutional powers remained unimproved; his tongue became brown, his pulse feeble, and appetite bad; still his spirits were good, and he seemed confident of recovery; but on the 1st of September, at 10 P.M., the dresser was sent for in consequence of a hæmorrhage from the wound; before his arrival in the ward, the bleeding had, however, ceased, not more than about four ounces of arterial blood having been lost. The next day the spirits of the patient were much depressed; pulse 96, and feeble, and a sanious discharge continued the whole day from the wound; the ligature now seemed to protrude farther from the wound, as if it were separated from the artery; but owing to the tendency to hæmorrhage, the dresser dared not ascertain the fact; on the 3rd of September, bleeding again occurred; about four ounces of blood were lost, but the bleeding was stopped by pressure; in two hours, however, another gush of blood occurred, when Mr. Hilton was called into the ward, and applied a tourniquet over the artery, and thus completely commanded the bleeding. The hæmorrhage not returning on the 6th, the tourniquet was removed; no blood followed; but a fœtid, grumous discharge, apparently from the sac, oozed from the wound. A sloughing over the ilium, which seemed to have been produced by the pressure of the tourniquet, now commenced: the patient gradually became weaker; his appetite continued bad; his pulse was 130. The grumous discharge increased, the sac becoming proportionably softer, and on the 15th, matter appeared to be making its way down the thigh; an opening was made, and a considerable quantity of grumous matter, similar to that discharged from the wound, was evacuated; his pulse could now scarcely be counted, from its feebleness and rapidity; his face was bedewed with perspiration. At 11 P.M., on the same day, arterial hæmorrhage came on, and at 12 o'clock he died.

Examination twelve hours after death.—The parts about the wound were in a state of gangrene. The external iliac artery was divided at the point where the ligature had been applied, and the two ends were gangrenous. Upon making a section of the upper portion of the artery, a firm coagulum, about half an inch in length, was found, but at some distance from the truncated extremity, the interspace being filled with the same kind of grumous matter which had been discharged from the wound during life. The bleeding had evidently taken place from the lower extremity of the artery, in which no coagulum was found. The femoral artery passed through the centre of the diffused aneurism, and just below, where the profunda was given off, a second aneurism was found.

William West, æt. 36, was admitted into Guy's, 20th January, 1847. He stated that about three months before his attention was first attracted to a pulsating tumour, about the size of a pullet's egg, situated in the left groin, just below Poupart's ligament; he could not trace it to any cause, never having received either a blow or sprain; the tumour remained unchanged in form or size until two days previous to his admission into the hospital, when, while walking briskly along the pavement, he slipped off the kerb-stone, falling heavily in the road; at the same time he most distinctly felt the tumour give way: the thigh immediately became much enlarged, and he stated that he distinctly felt "something hot running down the inside of his thigh." He was carried home, and remained in bed thirty-six hours, suffering considerable pain from the great distention of the integuments of the thigh, attended by a sensation of numbness and cold in the leg. On the afternoon of the second day after the accident, he was brought to the hospital. About four hours after his admission, I saw him. On examination, I found the left thigh nearly double the size of the right, being particularly prominent about the upper third of its anterior surface; but the whole thigh was tense, the extravasation of blood extending to the knee, and pulsation being distinctly evident throughout the whole course of the thigh. I felt assured that delay was inadmissible, and immediately proposed to the patient the application of a ligature around the external iliac artery: he consented, and was removed at once to the operating theatre. The steps followed in this operation were the same as those in that last described, the artery being very easily exposed. The ligature came away on the twenty-third day, and the patient recovered without any bad symptom; the only point worthy of notice being the circumstance that the temperature of the limb operated on always exceeded (during the progress of the cure) that on the healthy side by three or four degrees.

I have performed this operation successfully in one other instance, but cannot find the details of the case. I therefore only mention it here, as it appears to me desirable that in an operation so important, correct statistical accounts should be preserved, to show the proportion of cures out of the whole number of operations performed. I believe, that although from its situation the placing a ligature around the iliac artery is a formidable operation, a favourable result can be more confidently anticipated than in the case of any other artery of great magnitude: this arises from two principal circumstances—firstly, that through the greater part of its length—viz. from the sacro-iliac symphysis to Poupart's ligament—no branch of any importance is given off so as to interfere with the formation of the clot; and that, secondly, the free anastomosis between the branches of the internal and external iliac arteries on the thigh is sufficient to carry on the circulation to the lower extremity.

LECTURE LXI.

CONTINUATION OF DISEASES AND INJURIES OF THE VASCULAR SYSTEM.

Tying the femoral artery—Usually required for popliteal aneurism — Frequency of popliteal aneurism — Cases of tying femoral artery—Difficulties arising from unusual distribution of the vessel —Popliteal aneurism does not necessarily indicate aneurismal diathesis—Prognosis favourable in tying femoral artery—Tying popliteal artery—Generally inadmissible—Reasons why—Tying posterior tibial artery—Tying posterior tibial in the middle of the leg—Tying anterior tibial artery—Treatment of patients before and after operation—Separation of the ligature—Question if proper to apply a ligature for aneurism, when aneurismal diathesis is evident—Can only be determined by the judgment of the surgeon—Conclusion.

Operation of tying the femoral artery.—This operation is most frequently required in aneurism of the popliteal artery, or of the lower portion of the femoral artery itself: it may, however, be rendered necessary by wounds of the femoral, and in cases of secondary bleeding after amputation, when the hæmorrhage takes place so long after the operation as to render it unadvisable to lay open the stump. In my own practice, I have tied the artery under each of these different circumstances.

The comparative frequency of popliteal aneurism is not easily explained; it has been attributed to peculiar kinds of employment, which affect the position of the limbs, or require the constant exercise of particular muscles: thus postilions and coachmen have been said to be most subject to popliteal aneurism. My own experience does not, however, support this view; and I am inclined to think that persons who, from the nature of their occupation, are obliged to carry great weights, are most susceptible to the disease.

In reviewing the anatomical relations of the popliteal artery, it will be seen that through the greater part of the popliteal space it derives but little support beyond that afforded by the loose cellular tissue of the region; and that, during the violent motions of the knee-joint, the vessel is subject to great tension and contortion.

This vessel also sends off within the popliteal space the superior and inferior pairs of articular arteries, and a large azygos branch which supplies the interior of the knee-joint. The branching off of these vessels, particularly the single one which springs from the centre of the main trunk, must, I think, weaken the artery. Another circumstance which proves to me that the frequency of popliteal aneurism arises from some peculiar physical cause, is the fact, that many persons have had aneurisms in this region on both sides when there appeared to be no aneurismal diathesis: and I have myself performed the operation on both extremities in three several cases.

On Dec. 22nd, 1839, G. Wooding, æt. 38, was admitted into Guy's Hospital, with aneurism of the left popliteal artery: his occupation entailed the necessity of carrying great weights, from 1½ to 3 cwt. Ten months before his admission, when heavily laden, he slipped down a stair; at the time he experienced great pain in the knee: this, however, soon left him, but afterwards recurred, and for three months previous to his coming into the hospital he had had a swelling in the ham of the size of a walnut. This was a great impediment to his walking, and he was obliged to give up his usual employment a week before he came into the hospital. When admitted, he seemed to be in good health; stated that he had never taken mercury; and that, although he took porter freely, he was not a drunkard. The left popliteal space was completely occupied by a firm tumour; by slight pressure of the artery above the tumour, the swelling was rendered less tense, but the general pulsation became more distinct.

On Dec. 26th, I applied a ligature on the femoral artery, about an inch below the profunda; the sheath was much redder than usual, and thickened, as if from inflammatory action: two nerves accompanied the artery. I passed the aneurismal needle under the artery, without the ligature, which I threaded through the needle after it was placed beneath the vessel. I then brought the edges of the wound together. On the eighteenth day the ligature came away, and the patient shortly after left the hospital quite cured. In the course of about two years from the date of the first operation, this man again appeared at the hospital with an aneurismal tumour in the opposite ham. In the left ham, where the operation had been previously performed, not a trace of aneurism could be found; but on the right side there was a pulsating tumour, about the size of half an orange. On March 2nd, 1841, I tied the right femoral artery for this second aneurism. On passing the aneurismal needle, rather a brisk venous hæmorrhage occurred; but on tightening the ligature it immediately ceased: and this I have several times found to be the case—so that venous hæmorrhage never now causes me to hesitate in securing the artery at once, as this, I have found, invariably stops it. The temperature of the limb upon which the operation was performed was in this case 5° above that in which the artery had been formerly tied. The ligature came away on the thirteenth day, and the patient left the hospital on the 4th of April, quite recovered. He has ever since followed his original laborious occupation, and has within a week paid a visit, in perfect health, to the sister of the ward in which he was placed when in the hospital.

Thomas Forster, a bricklayer, æt. 28, of a leuco-phlegmatic temperament, was admitted, 19th July, 1836, with popliteal aneurism on the right side. I tied the femoral artery on the second day after his admission, as he suffered considerable pain in the limb. The ligature came away on the eleventh day, but the wound suppurated, and was a long time in healing. He, however, left the hospital, perfectly convalescent, seventeen weeks after his admission. Four years afterwards, on the 14th of March, 1840, Forster was again admitted for popliteal aneurism in the left limb, the tumour being situated lower than usual, just at the division of the artery into its tibial branches. Venous hæmorrhage occurred in passing the aneurismal needle in this case, but it ceased on tying the artery. The patient left the hospital quite well.

My third case of popliteal aneurism on both sides I have already related when speaking of the cure of aneurism by compression.

To place a ligature round the femoral artery, the patient should be placed in the recumbent posture, the limb to be operated on being rotated outwards, with the leg slightly flexed over a pillow, as by these means all the muscles of the extremity are relaxed, while the pillow affords a firm support, which relieves the patient from that anxiety which all persons feel when about to submit to an operation, lest any movement of theirs should mar its success, or expose them to danger. When the patient is properly placed, an incision is made, commencing about two inches and a half below Poupart's ligament, and extending downwards in the course of the sartorius muscle for three inches. Sometimes, however, it is difficult to distinguish this muscle, in consequence of the œdema which so frequently accompanies aneurism in consequence of the interrupted circulation. In that case, the situation of the artery may be ascertained by placing one end of a tape in the centre of Poupart's ligament, and the other on the inner side of the patella; while a second tape is to have its upper extremity placed on the anterior and superior process of the ileum, and its inferior on the tubercle of the internal condyle of the femur—the spot at which these two lines cross each other is that at which the ligature is to be applied upon the artery: by commencing the incision, therefore, an inch and a half above this point, and carrying it an inch and a half below, we arrive immediately at the point we desire to reach. Such mechanical rules, however, are usually unnecessary, as the inner edge of the sartorius muscle is itself sufficiently evident to guide you. The first incision should only expose the fascia lata, which is next to be divided to the same extent as the skin; and in each of these steps care must be taken not to wound the saphena major vein, which may be exposed to danger. The fascia being divided, the inner edge of the sartorius muscle comes into view, and may be always recognised, by the direction of its fibres (from without to within). The muscle is to be drawn outwards by a retractor, and the sheath of the femoral vessels will be presented to the view. This is to be pinched up with a pair of forceps, and a small opening cautiously made into it: the opening is to be afterwards enlarged with a probe-pointed bistoury, or by a scalpel, having first passed a director into it to secure the artery from danger; the aneurismal needle is next to be passed under the artery, directing it from within to without, and using the instrument in its passage, to separate the artery from the vein which is behind it. As I have before said, I rarely arm the needle until after I have placed it under the vessel, as it passes much more freely when unencumbered with the silk.

After the needle is passed, the ligature must be tightened, we are told, with a sufficient degree of force to divide the inner coats of the artery: you are not, however, to suppose that you will be aware of the giving way of these coats; and the knowledge of the amount of force necessary to be applied for this purpose can only be acquired by operating upon the dead subject; but even this will not afford much guide, for the force to be exerted must often be modified according to the age of the patient; as in old people, in whom there is great liability to ossific deposits in the arteries, the ligature must be less tightly applied than in younger patients. As soon as the ligature is effectually tied, the pulsation in the aneurismal tumour will cease, and the tumour itself will become more or less flaccid; but this does not always occur, as there may be some unusual division of the femoral artery above where the ligature has been applied, so that the tumour may yet be supplied with blood, and its pulsation continue. Under these circumstances, the abnormal branch must be sought for, and generally it will be easily discovered, in consequence of the inordinate action produced in it, by the application of the ligature upon the other branch; it should be immediately exposed, and secured, as otherwise the first ligature will probably prove ineffectual. If, however, the pulsation of the tumour be very much diminished by the first ligature, I should be disposed to try the effect of compression before I secured the second vessel.

I shall now relate a series of cases; many of them had a fatal termination; but I have selected them in preference to those ending successfully, inasmuch as they show the points of difficulty that are likely to arise, not only in the operation itself, but likewise in the subsequent effects on the constitution of the patient, and the influence exercised by extraneous circumstances over the curative process.

In February, 1837, I was requested by Mr. Balderson, of Poland-street, to visit an Italian gentleman, Signor Marani, about thirty years of age, who had a small aneurismal tumour situated in the lower part of the left popliteal region; and this had increased so much in size for the few days before I saw him as to lead him to seek surgical advice. Upon examination of the limb, I was surprised to find a cicatrix in the usual situation for tying the femoral artery; and upon making inquiries on the subject, he recounted to me the following circumstances:—In the August before, he had first perceived the pulsating swelling which now existed in the ham, and had discovered it by accident while pulling on his stocking, but that it gave him no pain; he instantly consulted Mr. George Greeves, of Manchester, who explained to him the nature of his case, and that the only means of relief was by surgical operation; this was performed early in the September following, in the presence of Mr. Wilson and another medical gentleman. I immediately wrote to Mr. Greeves for further information on the subject, and the following is an extract from his reply:—"In September last I was consulted by Signor Marani, whom I found labouring under popliteal aneurism, and for whom I tied the femoral artery in the usual manner. The case did remarkably well as far as referred to the separation of the ligature and the speedy healing of the wound; but in twelve hours after the operation, the pulsation of the tumour recurred, although at the moment the ligature was tightened, the pulsation entirely ceased in the sac, which became flaccid, and, in fact, could scarcely be felt." There can be no doubt but that the femoral artery had been most properly secured, and that the continuation of the pulsation of the tumour depended upon some unusual free anastomosis, or an irregular distribution and division of the femoral artery itself; and the latter was the opinion of Mr. Cusack, whom Signor Marani consulted in Dublin, to which place he was obliged to make a visit.

From this account I was induced to make a very strict examination of the limb, and in the course of the cicatrix, I could discover the pulsation of a vessel apparently about half the size of a healthy femoral artery; but pressure on this vessel did not command the pulsation of the aneurism. In the lower third of the thigh, just where the femoral artery perforates the tendon of the adductor magnus muscle, the pulsation of the artery was very perceptible, and pressure here immediately stopped the pulsation in the tumour. I did not, however, keep up this pressure sufficiently long to ascertain whether by delay anastomosing vessels might not have supplied the tumour with blood; but took it for granted from this experiment, that a ligature applied to the femoral artery while within "Hunter's canal," would lead to a cure of the aneurism. I explained my views of the case to my patient as to the probable circumstances which had led to the failure of the last operation, and proposed the application of a second ligature, to which he consented, and I performed the operation on the 18th March, 1837.

I placed the patient in the same position as for tying the femoral artery in the high operation, and commenced the incision in about the middle of the inferior third of the thigh, extending it upwards so as to encroach upon the middle third, taking the line of direction towards the centre of Poupart's ligament, and parallel with the tendon of the adductor magnus muscle, which could be readily felt, and even seen by slight abduction of the limb. This incision exposed the fascia lata, some care being requisite to avoid the saphena major vein. The fascia lata was then divided, and the sartorius muscle laid bare; the latter was drawn downwards exactly in the contrary direction to that in which it would be placed in the upper operation. The aponeurosis, extending from the tendon of the adductor magnus to the vastus internus muscle, could now be seen, and, lying upon it, the saphena nerve. I laid open this fascia, when I expected to expose, as usual, the artery; but I had still to continue my dissection considerably deeper, so as to separate the tendon of the adductor muscle from its attachment to the femur, and to reach the popliteal space before I could secure the vessel, which I accomplished, but with considerable difficulty. Immediately after the ligature was applied to the artery, the pulsation in the tumour ceased, but in a few minutes became as distinct as before the operation. I examined more deeply into the wound, but as no other artery could be discovered, nothing further could be done than to dress the wound. I found, upon further examination, I was still able to command the pulsation of the tumour by pressure above the wound, and I therefore placed the limb in a flexed position upon a pillow, and applied a firm compress on the aneurism; and, notwithstanding the severity of the operation, Signor Marani remarked that he had lost the painful sensation in the limb which existed prior to the operation. Considerable irritative fever followed the operation, and the action of the heart and arterial system generally became much affected. Bleeding, calomel, opium, and saline medicines, were had recourse to; and to my great satisfaction, not only were the severe symptoms overcome, but on the fifth day after the operation all pulsation in the aneurism had entirely ceased, and from that period never recurred.

Before the patient's recovery was complete, however, Mr. Balderson and myself both suspected he was the subject of aneurism of the abdominal aorta, and Sir Astley Cooper was requested to visit him in consultation with us: he gave it as his opinion that the inordinate action depended upon the natural irritability of the constitution, prescribed the sesquichloride of iron, and recommended him sea-air: in a fortnight he seemed to be perfectly recovered, and returned to town, as he said, quite well; and no vestige of the aneurism could be felt. Signor Marani soon left London for Milan, his native place; and three years after, I was informed by a friend of his living in London, that he had died suddenly from the bursting of an internal aneurism.

Sir Astley Cooper had once a case somewhat similar to this, in which he had tied the femoral artery in the usual situation for popliteal aneurism. Nothing particular occurred until a few days after the ligature had separated, when an abscess formed in the sac, burst, and hæmorrhage repeatedly occurred, and ultimately destroyed the patient. Upon dissection, it was found that a large branch had been given off by the femoral artery above where the ligature had been applied, and had again united with the femoral just where it became popliteal, and thus the obliteration of the sac had been prevented. Such a distribution might have existed in the case of Signor Marani; but if so, a further variety must have existed in the course of the popliteal artery through the adductor magnus, unless Mr. Greeves' operation had obliterated that trunk, and the vessel which I had tied been the abnormal trunk: but even under this supposition, there remains this inexplicable fact, that my ligature did not permanently stop the pulsation of the sac. To this it may, perhaps, be answered, that the result of Mr. Greeves' operation would be to have enlarged all the anastomosing branches, which for the time, until obstructed by the inflammation consequent upon the second operation, had conveyed the blood to the sac. The following supposition of the unnatural division of the femoral artery would give a solution of the mystery in which this difficult case is involved. If a considerable branch were given off by one of the perforating vessels of the profunda artery, and had taken its course so as to enter the popliteal artery in the ham immediately above the sac, the application of a ligature upon the femoral artery below the profunda would not prevent the flow of blood into the aneurismal tumour; the second operation therefore became necessary. Such a distribution, accompanied also by the obliteration of the superficial femoral artery resulting from the operation of Mr. Greeves, sufficiently accounts for the circumstance of my not finding that artery in the usual situation perforating in the adductor magnus muscle; while the pulsation in the cicatrix of the original wound might be referable either to the enlargement of some muscular branch, or from a high division of the anastomoticus magnus. This explanation will also accord with the fact, that my deeper dissection into the popliteal space led me to the main trunk supplying the sac, while the pulsation which returned for a time showed that the ligature was placed above, and so near the abnormal communicating branch, as to lead secondarily to its obliteration; and not until then could the pulsation in the tumour cease.

The following case will show that other circumstances, besides an unusual division of the vessel, may render the operation for popliteal aneurism unsuccessful :—

September 6th, 1834, Mr. Green proceeded to tie the femoral artery in the usual situation for popliteal aneurism. On making the first incision on the inner side of the sartorius muscle, he exposed the sheath of the artery, which was normally distended, and upon laying it open, the femoral vein could be seen completely covering the artery : the vein was drawn inwards, and the artery was found unusually deep-seated, and dividing into two trunks of equal size, as if this were a low division of the femoral into the superficial and profunda branches. Mr. Green therefore continued his dissection upwards, to expose the artery above this division : in the progress of his dissection he wounded a considerable branch, and then at once decided upon placing a ligature upon the main trunk, above and below the wounded branch, and divided the vessel between the two ligatures.

The patient went on well for a week, when symptoms of gangrene appeared in the foot, and the leg was subsequently amputated below the knee. The result in this operation is what may be almost expected when a ligature is placed above the point where the profunda branch springs from the femoral. It does not, however, invariably occur, in consequence of the freedom of the anastomoses between the internal iliac artery and the arteries of the thigh.

William Groves, æt. 66, was admitted into Lazarus ward, July 1840, with a large aneurismal tumour in the left popliteal region: he was by trade a tanner, and his employment was very laborious, he was obliged to stoop a great deal, and was also much exposed to wet. The pulsation of the tumour was distinctly evident in every position of the limb, and the patient often experienced considerable pain in the swelling: the pain was always relieved by pressure, and by keeping the limb in the flexed position. Compression on the femoral artery readily stopped the pulsation in the sac, the contents of which appeared to be entirely fluid. The man had latterly become much emaciated; his appetite was, however, pretty good, but his rest at night was interrupted by sudden startings. Auscultation gave no evidence of any other aneurism. On the 7th of July, five days after his admission into the hospital, I tied the femoral artery in the upper third of the thigh, and he seemed to suffer less than usual from the operation: the pulsation of the tumour ceased immediately upon the application of the ligature, and the swelling became flaccid; the patient was put to bed with the limb enveloped in flannel. There was some numbness of the limb, the temperature of which was higher than that of the sound one. A slight degree of pulsation returned in the aneurism, but ceased the next day; and for three or four days after the operation the patient continued to go on well. On the fifth day considerable hardness and inflammation were found extending up to Poupart's ligament, and matter was discovered in the direction of the sartorius muscle; a large poultice was applied to the limb, and calomel-and-opium given at bed-time. The patient remained without much change, until the 17th inst., when he was attacked by delirium and vomiting. Effervescing draughts, with excess of ammonia, and a few drops of laudanum, were ordered; he was also allowed to take some porter, which he preferred to wine: he continued, however, to get worse, and died on the 18th instant. He presented at the time of his death the appearance of a patient affected with cholera. After his death, I learned that he had led a very intemperate life, and that he had been intoxicated the evening before his admission into the hospital.

When examined after death, the body was found to be lean, the leg operated on livid, the surface of the abdomen fresh; the cuticle was separating from the arms. The right pleura was partially coated by a thin fibrinous layer; the posterior surface of the right lung was hepatized, easily lacerable, and watery. The left lung was confined by some old adhesive bands in several places, and in one spot at its posterior part there was a patch of a greenish colour, as if altered by gangrene; the heart was covered with opaque spots, and was quite flabby; the aorta was large and senile; the liver was also pale, flabby, and easily lacerable: but there was no evident disorganization of any of the abdominal viscera.

August 16, 1836.—James Kidd, aged 30, was admitted into Luke's ward with a popliteal aneurism on the right side: on the day after his admission the femoral artery was tied. The patient went on well for a few days, when gangrene of the part supervened; and amputation was found necessary: three days after, secondary hæmorrhage set in, and the patient died. In the post-mortem examination no other aneurism was found, but there was very extensive visceral disease.

Thomas Harrison, æt. 57, was admitted into Luke's ward under the late Mr. Morgan, 20th July, 1842: the patient was the subject of a popliteal aneurism in the right side; he had only observed the swelling three days before his admission; he stated that he had been very subject to rheumatic fever, to which he had attributed the pain in his knee. On the 26th, Mr. Morgan tied the femoral artery in the usual manner. On the 9th of August the ligature came away, and the patient seemed to be rapidly advancing to convalescence, when he was suddenly attacked by inflammation of the pericardium and pleura in its most acute form: from this he never recovered, but died on the 15th inst. Before the operation was performed, he was submitted to a strict examination by auscultation, and no other aneurism could be detected, but as a post-mortem examination was not permitted, this opinion could not be verified. Death from secondary hæmorrhage, at the period of the separation of the ligature from the femoral artery in its middle third, rarely occurs; and this, perhaps, is attributable to the smallness of the branches given off by that vessel, and the great freedom with which its profunda branch above the ligature anastomoses with the inferior portion to supply the whole of the lower extremity.

As a proof that the cause of popliteal aneurism is much more usually local than diathetic, may be adduced the comparative infrequency of aneurism generally. I know that it has been asserted as a principle, that when aneurism of any vessel exists, there is almost always an aneurismal disposition in the other arteries; and that although the operation may succeed for the time, ultimately the patient will die of aneurismal disease. But the result of my own experience, with respect to popliteal aneurism, shows the fallacy of this opinion as a general rule; even in the cases I have mentioned, where both popliteal arteries have been thus diseased, the fact of the individuals having for years since the operation followed laborious avocations, seems a sufficient proof that the cause of the lesion is strictly physical.

Compared with the important and highly dangerous character of the disease, there is perhaps no surgical operation which offers greater hope of success than that of applying a ligature on the femoral artery for popliteal aneurism. In my own practice I have found the average of success greater than in any other operation; and I believe that where the constitution is unimpaired, a successful result may be looked for almost with certainty.

It is not advisable to perform the operation for popliteal aneurism at a very early period after the formation of the tumour. It is better to wait until the obstruction in the main vessel has led to the distention of the collateral branches, so as to ensure a free channel for the blood when diverted from its natural course by the application of a ligature; on the other hand, it is equally improper to procrastinate the operation, so as to allow the tumour to acquire such a size as may interfere with the functions of the surrounding tissues.

The operation of tying the popliteal artery within the ham appears to me inadmissible under any circumstances. The great depth at which the artery is placed; the necessary interference with the posterior crural nerve and popliteal vein; and the separation of the articular branches from this vessel within the popliteal space,—all point out the impropriety of such a step: and these circumstances would always be sufficient to direct the choice to the tying the inferior third of the femoral artery, as I have already described. In making this choice, if it be found that the large anastomotic branch of the femoral artery be so much increased in size as to lead to the supposition that it may, after the main trunk has been tied, still convey sufficient blood to the sac to prevent its obliteration, it should also be secured; nor does this step much complicate the inferior operation, for the branch is generally given off just as the femoral artery enters "Hunter's canal," and indeed should always be looked for, so that the ligature may not be placed so near to it as to interfere with the formation of the clot in subsequent obliteration of the femoral artery itself. One of the best proofs of the danger resulting from the attempt to tie the popliteal artery itself, is the great fatality that followed the old operation for popliteal aneurism—viz., the laying open the sac, and tying both ends of the vessel.

Tying the posterior tibial artery may be requisite, in consequence of wounds in the vessel, from the formation of a traumatic aneurism, or from wounds of the plantar arteries in the sole of the foot. It may require to be tied in any part of its course, but is most frequently secured behind the inner ankle.

Operation of tying the posterior tibial artery behind the malleolus internus.—To expose the artery in this situation, the patient should be placed recumbent, and the limb to be operated on turned on the outer side with the knee semiflexed, the foot being also slightly flexed : a curved incision should then be made, commencing an inch above the malleolus internus, and midway between it and the tendo-Achillis; and passing round about an inch below the malleolus internus, being made to terminate at a point directly below its anterior edge. This incision is merely to penetrate the skin, so as to expose the superficial fascia, which is then to be divided to the same extent: a quantity of loose cellular membrane, with more or less fat, will require to be removed for the purpose of laying bare the deep fascia, which is here very strong, and connected with the tendons of the muscles that pass through this region to the sole of the foot. This deep fascia is next to be cut through; when close to the malleolus the tendons of the flexor longus digitorum will be seen; below and behind this, and between it and the os calcis, will be found the posterior tibial artery, with its venæ cavæ, or should the large posterior tibial nerve be brought to view, the surgeon will at once know that the artery must be lying between it and the malleolus. When the vessel is exposed, it is to be separated from its veins, and the ligature may be passed around it in the usual manner. The tendon of the flexor longus pollicis is placed behind and below the artery and between it and the os calcis; so that, if the incision happens to have been made too far backwards and downwards, and this tendon exposed (and it may always be recognised by moving the great toe), the artery must be sought for in front and above the tendon. The tendon of the tibialis posticus, which also passes behind the malleolus internus, is not brought into view in this operation, in consequence of its being covered by the tendon of the flexor longus digitorum.

Operation of tying the posterior tibial artery in the middle of the leg.—This is a far more difficult operation than the one last described, but with due care the difficulties are by no means insuperable: the patient should be placed in the same position as in the last operation, excepting that the foot should be extended instead of being flexed. An incision is then to be made, of three inches in length, commencing about a hand's breadth below the head of the tibia, in the course of the internal edge of that bone, penetrating only the skin and superficial fascia. The tibial origin of the soleus is thus exposed: and in making this incision, great care is necessary not to get behind the tibia; for if this is done the deep fascia may be at once cut through, and the guide to the future steps of the operation entirely lost. The soleus is next to be separated completely from its attachment to the tibia and deep fascia, the latter being thus distinctly brought to view. This is the most important step of the operation, as it alone can afford the surgeon an exact knowledge of the situation of the artery. The fascia is next to be divided to the same extent as the external incision, when the deep-seated muscles between the tibia and fibula will be exposed. The foot is now to be extended to its utmost, for the purpose of relaxing the muscles of the calf of the leg, so that the fingers of the operator may be readily admitted into the wound; and at about an inch in depth, midway between the tibia and fibula, the artery will be found, with the posterior tibial nerve lying on its fibular side. An aneurismal needle is then to be passed under the artery, from without to within; and its venæ comites being separated from it, the vessel is to be secured. Mr. Guthrie has recommended another mode of operating—viz., that of placing the patient in the prone position, and making a vertical incision, of seven inches in length, through the substance of the calf of the leg, and thus reaching the vessel. I have tried this operation on the dead body, and found it infinitely more difficult than the one I have just described; and in the living subject the difficulty must be still greater, on account of the violent contractions that would occur in the muscles of the calf, and which would powerfully oppose that separation of the fibres necessary to the due exposure of the deep fascia, which I hold to be so essential to the completion of the operation.

The only time I ever tied the posterior tibial artery was for a wound just above the malleolus, whence there was great hæmorrhage. In this case I enlarged the wound and tied the artery both above and below the point of lesion. I acknowledge that I found much greater difficulty in securing the vessel than I had anticipated, and attribute this difficulty to having cut too deeply in my first incision, and divided the deep fascia, which should always be first exposed, that the precise point reached should be perfectly comprehended.

Operation of tying the anterior tibial artery.—This vessel may be tied in any part of its course, from the point where it perforates the upper interosseal hiatus to its termination in the dorsum of the foot;

and its course is marked by an imaginary line drawn from a point placed midway between the tuberosity of the tibia and the head of the fibula, to the interspace between the metatarsal bone of the great toe and the toe next to it. When it is to be tied in the upper part of the leg, an incision is to be made, three inches in length, in the course of the above-named line, through the skin, down to the fascia, when an opaque white line may be seen and felt, marking the separation between the tibialis anticus and extensor longus digitorum muscles; the fascia is next to be cut through to the extent of the cutaneous incision, and the muscles separated by the handle of the knife, when the anterior tibial artery and its accompanying nerve will be exposed, the nerve lying usually in front: the foot should now be flexed to its fullest extent, and the artery being separated from the vein and nerve, the ligature may be passed around it. Should it be necessary to tie this vessel in the remaining portion of its course, the only further consideration is with respect to its anatomical relations to the muscles placed between the tibia and fibula in front: for example—in the upper part of the leg the artery is placed between the tibialis anticus and extensor communis digitorum; while below it lies between the tibialis anticus and the extensor longus pollicis.

Should this artery be wounded on the instep, an accident which not unfrequently happens to shipwrights in the use of the adze, it should be secured by enlarging the wound on its fibular side, in the course of the tendon of the extensor longus pollicis muscle.

With respect to the wounds of the plantar arteries in the sole of the foot, the treatment to be adopted is the same as that followed in the wounds of the palmar arches of the hand; viz., compression at the point of injury, as well as upon the posterior and anterior tibial arteries. Should compression not check the bleeding, the posterior tibial artery may be tied with greater prospect of success than when the radial or ulnar are correspondingly tied for injury of the hand; for the anastomosis between the tibial arteries is not by any means so free as that between the radial and ulnar; consequently distal hæmorrhage is much less likely to occur.

Preparatory treatment of patients in aneurism is generally precluded, the surgeon being usually called upon to afford relief by an immediate operation; but should the opportunity present itself, great advantage may be derived from the judicious preparation of the patient. For some time before the operation he should be kept in the recumbent position, the limb being placed in the position most likely to facilitate the circulation through the collateral branches, so that they may become enlarged to fit them for the change that must necessarily take place from the additional amount of blood they receive when the ligature is applied to the main trunk. The state of the bowels should also be closely attended to; and with respect to diet, it should be sufficiently nutritious to maintain the constitutional powers of the patient, and not so stimulating as to increase the action of the heart and arteries. The treatment after the operation has been performed is generally much the same as that adopted previously; subject, however, to such modifications as may be required in consequence of the symptoms resulting from the operation itself. More or less irritative fever usually supervenes, which must be moderated by salines, sudorifics, and sedatives. Abscesses may form in the course of the wound, and protracted discharge of pus may so debilitate the patient as to lead to the necessity for the administration of tonics. In some cases the aneurismal sac may slough, producing such a degree of constitutional derangement as to render it a most important question whether the limb ought not to be amputated, in the hope of preserving the patient's life: and this question can only be decided by a just estimation of the extent of power, as to its competency to sustain the restorative process. If none of these untoward circumstances occur, the only treatment required is to place the limb in an easy semiflexed position, supported over a pillow, and wrapped up in flannel to maintain the natural temperature: should, however, the heat of the limb become too great, the flannel ought to be removed. Bottles of warm water should never be applied to the foot in these cases, as they create an artificial heat beyond what the lessened powers of the limb is capable of supporting, while flannel merely preserves the warmth naturally generated. The patient cannot be considered out of danger until the ligature has "separated:" this occurs at different periods, according to the size of the vessel, and in some measure to the constitution of the patient. In the large arteries the separation of the ligature takes places in from fourteen to twenty-two days after the operation, but sometimes even later than this, particularly if any structure has been included with the artery, in applying the ligature. Should the separation of the ligature be delayed beyond the usual time, the surgeon should not apply force to draw it away, as it appears that nature rarely throws it off until the artery is obliterated by the adhesive inflammation; and it is to be remembered that secondary hæmorrhage most frequently occurs upon the separation of the ligature, and that the danger from bleeding is lessened in proportion to the time that has elapsed after the operation. Much doubt may arise in the mind of the surgeon as to the advisability of placing a ligature around an artery in aneurism when there is evidence of an aneurismal diathesis; in that case it may still, in my opinion, be right to perform the operation, even if it were only from the hope of prolonging the life of the patient, and affording an opportunity of administering such remedies as are known to promote a spontaneous cure. This is a subject, however, that must be left entirely to the judgment of the surgeon, and can in no wise be provided for by particular rules, depending as it does upon symptoms that vary in every case that comes under the notice of the practitioner.

LECTURE LXII.

DISEASES OF THE VEINS.

Physical character of the veins—Nutrition of veins—Subacute inflammation of veins—Symptoms—Treatment—Effects of continued inflammation—Secretion of pus in veins—Obliteration of veins—Acute inflammation, termed phlebitis—Definition and classification of—Manner in which pus becomes mixed with the blood—Causes of phlebitis—Secondary affection—Symptoms—Phlebitis sometimes epidemic—Analogy to erysipelas—Ulceration of veins—Treatment of phlebitis—Earthy deposits in veins—Morbid growths—Varicose veins—Causes of varix—Progress of the disease—Treatment of varix—Cases.

In their physical structure the veins resemble very closely the arteries, being composed, like the latter, of distinct tunics or coats, which receive nourishment in the same manner as the coats of the arteries, from the small bloodvessels of the surrounding cellular membrane, the vasa vasorum. If these small bloodvessels become from any cause incapable of performing their natural office, the veins must undergo deterioration, and the function of the whole venous system ultimately suffer serious derangement. It is generally said that the external coat of the veins is little liable to the attacks of disease, which are usually confined to the inner or lining membrane; this idea seems, however, to have arisen from the greater apparent importance of the inner coat, rendering any abnormal change in it more evident, from its interfering with the circulation of the blood, while an equal amount of disease in the outer coat is not so likely to excite attention, as it produces less urgent constitutional effects.

When a vein is attacked by subacute inflammation, there may be at first but little constitutional disturbance, and the inconvenience will not exceed some slight local pain: trivial as this condition may, however, appear, it should not be neglected, and active measures ought to be adopted to subdue the increased action of the vasa vasorum of the affected vein: with this object the patient should be kept in the recumbent posture; purgatives, and such other medicines as promote the secretions generally, should be administered, and the limb ought at the same time to be maintained in that position which will most facilitate the return of blood to the heart. If inflammation in a vein be allowed to go on unchecked it often leads to the effusion of coagulable lymph, so causing adhesion of the sides of the vessel, and the consequent obliteration of its canal, a considerable extent of which may thus be rendered incapable of carrying on the circulation.

The secretion of pus sometimes follows upon inflammation in a vein: the matter will then either be mixed with the circulating blood, or if the vein has become impervious from the adhesion of its sides, the pus will collect and form abscesses along the course of the vessel.

Inflammation of a vein frequently produces thickening of its coats, as well as the obliteration of its canal, and it is stated by Mr. Hodgson that in some instances veins have been found resembling arteries in the thickness of their coats, and in remaining uncollapsed when cut transversely.

When a vein has been rendered impervious by the adhesion of its internal coat, the blood can only be conveyed to the heart by means of collateral circulation, and this appears to be carried on as completely in the venous as in the arterial system; for even after the obliteration of the largest veins the blood has continued to pass by anastomosing branches without interfering with any important function.

In the cases of obstructed venous circulation that come under the care of the surgeon, the disease is generally seated in the lower extremity, particularly in the veins of the left leg: this condition is attributed to the pressure of the sigmoid flexure of the colon upon the left iliac vein, retarding the flow of blood to the cava; it hence arises that purgatives which act upon the large intestines afford great relief at the commencement of the disease. In some cases I have punctured the diseased vein before the blood has become coagulated, and this treatment has produced considerable permanent benefit in one or two instances, but in others it appeared to hasten the obliteration of the vein, not by promoting coagulation of the blood, but by giving rise to adhesive inflammation. The cases which I have thus treated have been the result of a varicose condition of the vessel, and although the treatment seemed to be productive of advantage, it cannot be regarded as a means of permanently curing the disease; for even when the vein first affected is rendered impervious to the blood, the collateral branches become rapidly distended, and fall into the varicose condition.

In the examination after death of veins obliterated by inflammation, the internal coat is found much thickened, and the obliteration produced either by adhesion of its surfaces, or by the formation of a clot of blood, which becomes adherent to the internal coat: the largest veins of the body are subject to this disease, and instances are recorded of the obliteration of the superior and inferior cavæ, and the subclavian and iliac veins.

The obstruction is indicated by the venous congestion, and by the œdema of those parts of the body which should return their blood through these obliterated channels.

Inflammation of the veins has been very appropriately termed *phlebitis*: it may either arise spontaneously, or be produced by external violence. M. Cruveilhier has further divided it into—phlebitis of the superficial veins, phlebitis of veins embedded in the substance of organs, and capillary phlebitis; it is also again subdivided into adhesive phlebitis, where coagulable lymph alone is formed, and suppurative phlebitis, where matter is generated,—and the mixing of the latter with the circulating blood may produce the most violent constitutional symptoms, causing abscesses to form in different parts of the body, and generally terminating fatally. As this acute kind of phlebitis often follows abscess, it is believed by some that the pus is absorbed by the veins; but as pus is not unfrequently found present in venous blood without any abscess having formed, I am induced to believe that pus is more frequently secreted by the vasa vasorum or capillaries of the veins themselves; this view is not indeed inconsistent with the existence of abscess, as the pus may lead to irritation of the capillaries of the vein, and produce that condition of inflammation necessary to purulent secretion; for how often do we have large abscesses in the neighbourhood of veins without any of the symptoms of phlebitis arising. Whether the phlebitis arise, however, from wound, from direct absorption, or from imbibition, the phenomena are similar to those that occur when other tissues of the body are attacked by disease; the termination of the attack being either adhesive, suppurative, ulcerative, or gangrenous.

Phlebitis frequently results from inflammation following amputation, the application of a ligature, puncture, division or any lesion of an inflamed surface, in which the vein is involved. Sometimes the disease is limited to the vessel in which it is originally excited, at others it spreads through all the veins of the limb; but the danger seems to bear no sort of relation to the extent of the vessel implicated.

A very frequent cause of phlebitis is found in the punctured wounds accidentally inflicted in the dissecting-room; the disease is then supposed to arise from the absorption of a specific animal poison. I believe, however, that it is much more frequently the result of a previous constitutional deterioration than of the introduction of a virus. I am induced to take this view from the rapidity with which the local inflammation and consequent constitutional derangement follow the injury, while after the introduction of a virus, as in case of the bite of a rabid animal, a certain time, termed the period of incubation, always elapses before the accession of inflammatory symptoms.

Mr. Arnott has stated that the secondary affection in phlebitis generally begins from two to ten days after the infliction of the injury which is the cause of the inflammation. The symptoms are, great restlessness and anxiety, prostration of strength, and depression of spirits, sense of weight at the præcordia, frequent moaning, and oppressed and hurried breathing. The pulse is rapid, and there is often sickness and vomiting, with severe rigors. There is much irritability, and anxiety of countenance, with a quick and wild look and manner; and when left to himself the patient is apt to mutter incoherently, but becomes clear and collected when directly addressed; the features are shrunken, and the skin becomes yellow and sallow; effusion of pus and lymph frequently take place in situations distant from the original seat of injury; but the fatal termination of the attack usually happens under inflammation of the chest. Death is, at all events, always preceded by symptoms of extreme exhaustion, rapid pulse, dry brown or black tongue, teeth and lips covered with sordes, and low delirium. Phlebitis, in its adhesive form, cannot be looked upon as a very dangerous disease; its effects seldom reach beyond the affected vein, which is gradually rendered impervious by the coagulation of the blood; adhesive phlebitis may indeed exist without causing any inconvenience to the patient, and the disease is at this stage quite within the control of medicine. If, however, phlebitis, in its first stage, be neglected, it passes into that termed the suppurative stage. According to M. Cruveilhier, adhesive phlebitis is generally converted into suppurative by some irritation of parts already in a state of inflammation: the first change that occurs is the deposition of matter, which does not take place between the vein and the coagulum, but in the centre of the clot; and this pus ultimately becomes mingled with the blood, reacting powerfully upon that fluid. According to the same authority, pus, in its natural state, introduced into the blood, alters its consistency, clogs its course, gives it a tendency to coagulate, impedes its circulation in the capillary vessels, and causes inflammation to be set up in numerous points in the venous coat. Peculiar conditions of the atmosphere seem to act as an exciting cause of phlebitis, giving it almost the character of an epidemic. This appears to have been the case at the Hospital of the Hôtel Dieu, in Paris, in 1839, where almost every patient, after bleeding in the arm, was attacked by phlebitis. This disease was termed by M. Velpeau internal erysipelas; and certainly there appears to have been a great analogy between them; for at the period, and in the hospital above named, erysipelas supervened upon almost every operation, even of the most ordinary kind.

Ulceration of veins.—This disease is of rare occurrence, as the internal coat seems much more predisposed to undergo the adhesive than the ulcerative process; but in a protracted varicose condition, producing a subacute inflammation of the vein, ulceration sometimes happens, and profuse hæmorrhage is the result: but in these cases there may still be a doubt if the ulceration does not extend from without to within, not taking its commencement in the interior of the vein. In some instances, however, spots of ulceration have been found in the inside of veins, and probably the effusion of blood subcutaneously often results from this cause. Ulceration of a vein is not, however, attended by great constitutional disturbance, nor by any marked premonitory symptoms. No further treatment is requisite, therefore, beyond keeping the patient recumbent: the necessity for this is indicated by the sensation of uneasiness in the diseased vein while the person is kept erect; and if the limb were not kept raised, suppurative phlebitis would be very likely to follow.

With respect to the treatment of phlebitis, there is considerable difficulty; for, notwithstanding the high degree of local action by which it is characterized, the constitutional symptoms so rapidly put on the typhoid character, that depletion of any kind can only be employed with the utmost caution: promoting the secretions, therefore, and at the same time allaying irritation, is all that can be safely pursued. Calomel, antimony, and opium, combined, seem to be the best remedy, particularly when aided by the administration of liq. ammon. acetatis, tinct. of hyoscy. and camphor mixture. The affected limb should be kept elevated, to facilitate the return of blood to the heart; poultices and fomentations should be applied over the whole limb, and punctures made through the skin wherever it has become tense from effusion. As soon as the local irritation has been subdued by these means, bark and mineral acids, nutritious food, and porter, may be employed, and may be safely continued so long as the natural secretions are duly performed. M. Blandin has recommended the early application of leeches between the original point of inflammation and the first set of absorbent glands, with the view of preventing the formation of pus: I should, however, fear that the application of leeches would be dangerous, both from their depressing influence, and from their increasing the local tendency to inflammation; if there be any analogy between phlebitis and erysipelas, the danger must be rendered still greater: no surgeon should venture to apply leeches where there exists the least tendency to the erysipelatous inflammation. Earthy deposits are not very frequent in the veins; they occur however sometimes, and are called phlebolites. They have been found in the vena cava and saphena major veins; they are sometimes loose. Mr. Longstaff met with three calculi loose in the veins of the uterus. Morbid growths are occasionally discovered in the interior of the veins: they occur most frequently, I believe, when malignant disease exists in close proximity to a vein.

Varicose veins.—The veins are liable to become permanently dilated, either in limited portions, or throughout the greater part of their course—a condition which is generally attended by an accumulation of grumous blood, and sometimes by interruption to the circulation. This state of a vein is termed varix. Varicose veins not only become increased in their calibre, but they are also considerably elongated, and very tortuous in their course; often, indeed, being so coiled and irregular as to constitute distinct tumours.

This varicose condition of a vein is sometimes called hypertrophy; but a distinction ought to be made between mere hypertrophy and varix. Hypertrophy of a vein occurs where an excess of nutrition, either normal or morbid, is carried on in the part, the vein becoming thickened in its coats, enlarged in its calibre, and much elongated; but the integrity of the coat is preserved, the dilatation is uniform, and the circulation consequently unimpeded. If, on the other hand, a change occurs in the state of the venous coats at any point, a kind of pouch may be formed; the blood will have a tendency to coagulate at that spot; there will be a deposit of fibrin, and a species of tumour, very analogous to aneurism in an artery, is produced. Varices are most frequently found in the veins of the lower extremities, sometimes extending to the veins of the abdomen; and they have been known to occur in the upper extremities: the vena cava, vena azygos, and, indeed, all the great veins, have been met with in a varicose state: but the vessels ordinarily subject to the disease, are the venæ saphenæ and hæmorrhoidal veins.

The varicose condition usually advances very slowly, causing at first no inconvenience to the patient: after a time, however, the veins become gradually more and more distended, particularly if the limb be much exercised; they also become more tortuous and knotted, and a dull, heavy pain and numbness are complained of throughout the whole of the diseased part. As the disorder progresses, the limb begins to swell, and becomes œdematous—a condition almost invariably concomitant with long-existing varix.

Varices sometimes undergo a spontaneous cure, owing to coagulation of the blood taking place to a sufficient extent to plug up the canal of the vessel, and cause its complete obliteration. The vessel then becomes hard and incompressible, and is reduced to the condition of a mere chord, the circulation being carried on by collateral venous branches. The clot may sometimes act on an already inflamed vein as an extraneous body, producing ulceration, which not only destroys the coats of the vessel, but may extend to the surface. Hæmorrhage seldom however occurs as the result of this action, for the vein is generally previously obliterated. This ulcer is very difficult to heal, owing to the œdematous state of the limb. The cause of the varicose state is but little understood, but is supposed to proceed from some obstruction interfering with the reflux of the blood. The elongation and tortuosity acquired by the dilated vein appear to be a provision of nature to compensate for the want of the natural action of the valves: for it is evident, that when portions of the vein are brought into the horizontal position, the column of blood is broken, and the pressure rendered considerably less than if the whole were retained in a vertical direction. The rupture of the valves may, no doubt, in some cases prove the cause of varix, from the pressure of the whole column of blood being left dependent entirely on the coats of the vessel.

At present, surgeons are not acquainted with any certain mode of curing this disease. Gentle and graduated compression seems to be the most effective means of checking its progress, and relieving the œdematous swelling; but frequently, as soon as the compression is removed, the varices again make their appearance, and the pain and œdema return to as great an extent as before the bandages were applied. If nature has obliterated the diseased vein by the coagulation of its blood, and by the subsequent adhesion of its coats, there is nothing left for the surgeon to do but to support by gentle bandaging the collateral veins, to keep the bowels open, to recommend the patient to abstain from any violent exertion of the limb, and to maintain the recumbent posture as much as his usual avocation will admit. Laced stockings of various kinds have been invented for the purpose of maintaining the proper degree of pressure in the diseased vein; but of late years an elastic stocking has been introduced which is much more effectual, not only from the facility of its application, but from the equable pressure that it exerts. However strictly such a plan may be adhered to, it rarely proves more than palliative, for the altered structure in the veins seems to be irremediable; still, however, such a degree of comparative comfort may be secured as to render it quite a sufficient compensation for the trouble and inconvenience it entails. When the blood remains fluid, and the great distention of the veins forms the prominent feature of the disease, with alteration of the nutrition of the limb, and when purging, pressure, and recumbent posture give no relief, surgery affords to some extent the means of producing that coagulation of the blood in the diseased vessels which nature herself at other times is competent to effect. For this purpose, potassa fusa, nitrate of silver, ligatures, incisions, and other means, have been adopted for the purpose of leading to obliteration; but, as far as my experience goes, I have seen but little benefit obtained, even where the coagulation of the blood was effected by the treatment, as the collateral venous branches are very liable to become affected by the same disease: indeed, more than this is to be feared, as the inflammation may extend itself beyond the degree intended, purulent phlebitis may follow, and the life of the patient fall a sacrifice.

Many surgeons repudiate the dread of applying ligatures to veins, and maintain their views by pointing to the frequency with which veins are tied after amputations without any bad result. The answer to such an argument seems to me to be easy. After amputation, the ligature is applied to a truncated vein, and therefore the vessel is not subject to the irritating influence of a refluent current, as is the case when a ligature is applied to a varicose vessel; but even in the former case, instances are known of phlebitis following the application of the ligature; and surgeons rarely have recourse to this practice; nor, indeed, can I believe it even necessary; for even after amputation, if the venous hæmorrhage be troublesome after the artery has been tied, I have always found the removal of the tourniquet, the application of cold water to the stump, and the gentle pressure of a bandage, sufficient to check bleeding. The following case exemplifies the danger of surgical interference with varicose veins:—A patient was admitted into Stephen's ward with a large varix (containing coagulated blood) of the saphena major, on the inner side of the left knee: as the tumour was frequently chafed in working, the patient was anxious to have it removed; and as no pervious vein could be traced either to or from it, I prepared the patient, and extirpated the tumour.

No venous hæmorrhage resulted from the operation: a splint was placed behind the joint, to maintain the wound in a perfect state of quietude, and saline medicines, with narcotics, were prescribed. For a week the patient went on remarkably well; a blush of inflammation was then observed upon the inner side of the thigh: leeches and fomentations were ordered, but still all the symptoms of phlebitis supervened, and the patient died. I once removed a large tumour from the popliteal region of a surgeon, at Haslemere, and, during the extirpation of the swelling, wounded the saphena major vein, which ran through the substance of the tumour: I applied a ligature below the opening; in this case no bad symptom followed; but still I believe this practice to be dangerous, and I should now, under similar circumstances, try pressure, recumbent posture, and compress, as the means of stopping the venous hæmorrhage.

In cases of varicose veins, where the distention had been very great, and the skin had threatened ulceration from the tension, I have sometimes opened the vessel and abstracted a considerable quantity of blood; and, indeed, it has in such cases surprised me to find the amount of blood which may be withdrawn without producing any constitutional effect, leading me to believe that in aggravated cases of this disease the blood contained within the varicose veins is, to a certain extent, thrown out of the general mass of the circulating blood, and retained in a half-stagnant state within them.

The opening of the vein is frequently followed by the obliteration of the vessel, and in some cases seems to afford the desired relief; but yet, as I have before said, it much more frequently occurs that several of the collateral branches become the subject of a similar disease, so that the malady is rather increased than diminished.

Should an exostosis, or tumour of any kind, be the cause of interruption of the current of the blood through a vein, producing a varicose condition, nothing but the extirpation of the tumour will remove the affection of the veins.

LECTURE LXIII.

CONTINUATION OF DISEASES OF THE VEINS.

Accidental admission of air into veins—Not unfrequent in surgical operations—Effect of admission of air into a vein—Result of post-mortem examination in such cases—Question as to proximate cause of death—Circumstances that may lead to the accident—Indications of air having obtained ingress to a vein—Cases—Different opinions as to cause of death—Treatment—Necessity for great caution in performing operations in such localities as to render the admission of air probable if a vein be wounded.

Accidental admission of air into veins.—This accident has now frequently fallen under the observation of surgeons, and has, in consequence of the urgency and fearful nature of its symptoms, attracted such close attention and investigation, that a considerable amount of knowledge has been accumulated respecting it. Experiments upon the lower animals, added to close observance of the symptoms in cases in which, in the human subject, air has been accidentally admitted into the veins, prove beyond doubt that death may be, and has often been, produced by this casualty, during the progress of surgical operations; and the indications and symptoms attendant upon this occurrence have been so clearly pointed out by many writers, that there can be but little difficulty in distinguishing them under any ordinary circumstances. The fact has long been known, that air forcibly driven into the veins of an animal is capable of producing a degree of interruption to the function of circulation, sufficient, when the air is in considerable quantity, to cause instantaneous death; and when that quantity is less to produce symptoms of alarming character, and frequently to give rise to secondary affections of important organs, which, in general, prove fatal after the lapse of a longer or shorter period, according to circumstances.

When an examination is made after death, of an animal which has died from the admission of air into the veins, it is said that the right cavities of the heart, particularly the right auricle, are found distended by air mixed with frothy blood. Air may also be traced in other parts of the venous system, especially in the larger veins approaching the heart, and in the veins of the abdomen: indeed, it is stated by Dr. Cormack that in one of his experiments "air was found in every visible vein over the whole body." The presence of air could, however, be only proved in those cases in which death supervened rapidly upon its introduction; for, where the animal lived for any length of time after the experiment, not the least trace of air could be met with in the heart or veins. The question that arises is, then, What is the proximate cause of death when air is introduced into the circulating system? This is a question which I shall presently discuss.

When air has entered a vein spontaneously—that is, from the influence of the action of the heart alone—the accident has only occurred in veins placed so near to that organ that the blood circulating through them receives an alternate impulse and retraction from its diastole and systole; and it does not appear that air can find entrance when the puncture is far removed from the point at which the venous pulse can be distinguished; but if the puncture be made where the venous pulse can be felt, air is likely to gain admission. There are, however, circumstances which may cause the introduction of air into veins in which the venous flux and reflux cannot be observed in the normal condition. Thus, any circumstances which would tend to keep the vein in a patent state, so that its parietes could not collapse upon themselves, may be a cause of the extension of the influence of the heart's action, and the consequent admission of the air. The canular condition of a vein may be preserved in consequence either of disease in its coats by which they may have become thickened and hypertrophied, and thus rendered incapable of collapsing, or by the adhesion of the vein to surrounding tissue; or the canular form may be temporarily maintained by the action of the heart causing the reflux of the venous blood at the moment of inspiration. During surgical operations it is also probable that a similar state of patency may be produced in the vessel by tension, as during the removal of a tumour; or, lastly, it may arise from the action of the muscles of the part maintaining the vein, when intimately united to it, in a state of constant tension, and preventing the approximation of the parietes when they are cut through.

These considerations show us how much caution ought to be observed in operations about the neck and subclavian region, as the least puncture of a vein remaining open from either of the causes mentioned, would doubtless lead to the admission of air, and the train of symptoms consequent upon that accident.

When air has obtained admission into the veins, it is indicated by a peculiar gurgling noise, happily termed by the French "glou glou." This sound is heard only at the opening in the vein, that is, at the point where the air gains entrance. In the region of the chest and heart a sound of a different character is heard, a kind of bruit or churning, synchronous with the action of the heart. The immediate symptoms of the admission of air are impeded respiration, loss of strength, and interruption to the circulation of the blood. If a large quantity of air be admitted, the symptoms are greatly aggravated: the circulation seems to be suddenly arrested; the sufferer utters loud cries; the prostration of strength is excessive; there are strong tetanic symptoms, with opisthotonos; the urine and fæces are expelled involuntarily, and death very shortly supervenes; indeed, the fatal termination is said to have occurred in some cases instantaneously. The peculiar sound produced by the entrance of air into a vein, and the symptoms consequent upon that accident, are of a character calculated to produce a vivid impression upon the minds of those who witness them. It has once happened to me to do so in a case of my own.

A female, 19 years of age, was admitted into Guy's Hospital, May 17, 1843, with malignant disease of the humerus. Amputation of the shoulder-joint was determined on, and the 23rd of May was fixed as the day of operation. The arm was quickly removed, with very little loss of blood, the patient bearing the operation with great fortitude; the subclavian artery was secured, and I was proceeding to remove an enlarged gland from the axilla: while dissecting the gland away from its cellular attachments, I distinctly heard a peculiar gurgling noise; at the same instant the patient uttered a shrill cry, and suddenly fell into a state of collapse, the countenance was deadly pale; the pupils fixed and insensible to light; the pulse quick, small, and fluttering; the respiration irregular, and attended occasionally by a deep sigh. She was placed in the horizontal position, and various stimulants administered, but an hour elapsed before she could be removed from the operating theatre; when placed in bed she passed her urine and fæces involuntarily. When reaction was coming on she kept up a continued whining cry, and kept constantly moving the right leg, but she seemed insensible to feeling, and remained in other respects quite motionless. As sensation gradually returned, she complained of pain running up the right side of the head and neck, and for several days she remained with her eyes closed. On the 25th day after the accident, she was able to leave her bed, but she complained of great weakness and want of power in the left leg. On the 3rd of July she left the hospital without any unfavourable symptoms remaining, with the exception of a slight dragging of the left leg.

The following case occurred to Dr. Willis, of Barnes:—On the 25th of March, 1848, Dr. Willis performed the operation of putting a seton into the neck of a man suffering from chronic laryngitis: the seton needle was inserted about two and a half inches above the superior edge of the sternum: at the moment of its entrance, Dr. Willis heard a peculiar hissing sound, so that he thought he had opened a subcutaneous abscess communicating with the windpipe; a glance at the face of the patient told, however, of a more serious accident—the sound was produced by the entrance of air into a small vein that had been punctured in the operation. The man was deadly pale; he fainted, then became rigid and convulsed. Dr. Willis immediately compressed the orifice, to prevent the ingress of more air, and sent off to Putney for Dr. Cormack. Upon consultation it was decided on to try the effect of bleeding from the arm; the pulse, which was almost imperceptible, then became good, and the patient appeared to be in many respects relieved. Mr. Syme was now sent for; he concurred in the treatment that had been adopted, and suggested the application of warm fomentations to the feet, and the administration of a little wine: the patient did not, however, rally after this time, but continued in the same state until four o'clock in the afternoon, when he died.

After death the body was examined: it was found that the jugular veins and the large vessels of the neck were uninjured; but the right auricle and pulmonary artery were distended with frothy blood, and the lungs were emphysematous.

A young lady at Camberwell, about 19 years of age, had a tumour in the neck; she was placed under the care of Sir Benjamin Brodie, and he determined upon its removal. After commencing the operation he found that the internal jugular vein passed directly through the abnormal mass, and that it would be impossible to remove the latter without wounding the vein. He therefore placed a ligature upon the vein, above and below the points where his incisions were to be made in extirpating the tumour. In separating the tumour from its attachment to the surrounding structures, a small opening was accidentally made in the vein, unfortunately a little below the proximal ligature; a loud whizzing sound was immediately heard; the patient became suddenly insensible, her face was pallid, and there were present all the symptoms described as attendant upon the entrance of air into a vein: indeed, in this case the symptoms at the time were so urgent, that at one moment it was thought that the patient was dead; but after persevering in the use of stimuli, dashing cold water on the head and face, application of ammonia to the nostrils, and its administration internally, she began to show signs of returning animation, and, what is very remarkable, after a short time recovered without suffering from any of the distressing and protracted symptoms generally attendant upon this accident.

There can be no doubt that in this case the effects described arose from air obtaining ingress to the vein, but the quantity was only sufficient to cause immediate functional disturbance, and not to produce that prolonged interference with the circulation which appears to be the cause of death when a considerable quantity of air gains admission to a vein.

Mr. Skey once had a case in which, although he did not observe at the time the physical indications that air had entered the vein, there could be but little doubt of the fact from the symptoms that accrued. It happened in the operation for wry neck, and in one of the last incisions a large vein was opened behind the clavicle, probably the transversalis colli. One of the most prominent symptoms was a peculiar heat of skin and unusually rapid pulse; the patient died four or five days after the operation. Although this cannot be quoted as an unequivocal case of air in a vein, still the circumstances favour that view; and it would appear that although the air did not enter in sufficient quantity to produce immediate death, it was sufficient to interfere with the pulmonary circulation, a secondary disease, and to cause death in four or five days.

Experience in such cases has proved that when air obtains admission into a vein, the severity of the symptoms depends upon the quantity of air admitted; this is of course influenced by the state of the heart at the moment the puncture is made in the vessel, by the proximity of the wounded vessel to the heart, by its size, the character of the wound, and by the condition of the vessel itself, as to whether it be permanently canalized. The period at which death supervenes, after the admission of the air, depends not only upon the quantity of air admitted into the vein, but also upon the size and strength of the patient, and it seems to occur, as would indeed *à priori* be expected, more rapidly when the subject has been from any cause previously debilitated.

As to what really constitutes the proximate cause of death when air is admitted into a vein, great diversity of opinion exists; it is, however, a question of high importance, not merely with regard to the physiological inquiry, but in relation to the treatment to be employed in case of this unfortunate accident occurring. By some authors it has been supposed that death is caused by over-distention of the right cavities of the heart; by others, that it arises from the carbonic acid, formed by the action of the air upon venous blood, exercising a deleterious influence as it passes into circulation; by a third class, that owing to the presence of the air the blood is rendered incapable of passing into the capillaries of the lungs.

It appears to me that death may take place in consequence of excessive distention of the right auricle when air is forcibly injected into a vein, or when, in a surgical operation, owing to a combination of circumstances, a large quantity of air suddenly gains admission to the heart: the right auricle would then be incapable of contracting upon the air, perhaps from that fluid not furnishing the internal stimulus to the muscular fibres of the heart; immediate death would then be inevitable, as the action of the heart itself would be suddenly and completely arrested. In such a case death would be instantaneous; but when the quantity of air admitted into the vein is less, it becomes mixed with the blood, and then the circulation is only more or less impeded—clogged, as it were, with the presence of the foreign matter. As death does not here supervene with such great rapidity, time is obtained for the employment of remedial treatment: in some cases, as I have already shown, this may be sufficient to restore the patient—in others, the period of dissolution is only postponed. The supposition that when air enters a vein, death is caused by the poisonous influence of carbonic acid generated within the venous canal by the reaction of the oxygen of the air upon the carbon of the blood, is, I think, unsupported by any evidence that can be drawn from the phenomena symptomatic of such an accident; I believe, indeed, that where the quantity of air mixed with the blood is not sufficient to entirely prevent the contraction of the auricle, but passes into the circulation, and the blood is propelled in a frothy state through the pulmonary artery to the capillaries of the lungs, the admixture of air with the blood seems to present a physical impediment to the passage of the blood into the capillaries—the function of respiration is interrupted, and death ensues in consequence of the blood not undergoing those changes necessary to the restoration of its vital properties. It has been proved that the presence of air in a fluid materially impedes its circulation through capillary tubes; and some experiments upon this subject are detailed in an interesting paper upon the "Admission of Air into Veins," read by Mr. Erichsen at the thirteenth meeting of the Bristol Association.

An emphysematous condition of the lung has very frequently been found as a result of the admixture of air with the blood in the pulmonary artery. May not this distention of the air-cells of the lungs be produced by the influx of the air in the act of inspiration not meeting with resistance from the presence of blood in the pulmonary capillaries, so that the act of inspiration itself is sufficient to produce abnormal distention, if not rupture, of the auricle?

The same physical cause appears to destroy life when the circulation of the blood in the capillaries of the lungs is interrupted by the admission of a small quantity of air; as when, by the ingress of a larger quantity, the auricle becomes at once so much distended as to be incapable of fulfilling its natural function.

The rapid occurrence of death in this accident is not easily understood, when we compare it with death by common asphyxia, unless we attribute it to the tetanic contraction of the muscles causing sudden annihilation of the respiratory power; for in tetanus it is not uncommon to meet with cases of instantaneous death accruing from the spasmodic contraction of the glottis.

The experience of surgeons with respect to the treatment of cases in which air has unfortunately obtained ingress to a vein, is not yet sufficiently extensive to throw much light upon the subject. Compression of the thorax, and the abstraction of the air from the veins by a syringe, are the means often put in practice, and in cases where the symptoms continue urgent, it has also been recommended to open the temporal artery and right external jugular vein, for the purpose of relieving the distended cavities of the heart on that side. But when air has once obtained entrance, neither compression of the chest, nor any attempt to withdraw it from the veins by exhaustion, can, in my opinion, prove of the least advantage; indeed, either of these methods of treatment may in itself hasten the death of the patient. Powerful compression of the chest can scarcely fail to produce an ill effect by impeding the respiration, which is already weakened, thus diminishing even the small quantity of blood which may otherwise obtain its proper degree of oxidation in the lungs. The introduction of a syringe seems to me both useless and objectionable: useless, because, even if it were introduced, I do not believe that the air could be withdrawn by its agency; and objectionable for two reasons—first, if the wounded vein could be found it would be almost impossible to introduce a tube without allowing a further quantity of air to rush in, which in itself may be sufficient to cause immediate death; and secondly, the introduction of any foreign body into a vein would certainly produce phlebitis, a disease almost as dangerous as the one with which the surgeon already has to cope. Compression of the chest by a firm bandage before the operation, is a precaution that I think may be advantageously employed prophylactically; for if a vein were accidentally opened at the moment of a deep inspiration, the entrance of the air would be promoted, owing both to the patent condition of the vessel at the time, and the force of the refluent current which conveys the blood into the right auricle. Pressure on the parietes of the chest prevents deep inspiration, and would therefore, if it did not entirely prevent the admission of air, certainly limit the quantity that could be introduced.

Prevention must be the great object with the surgeon in reference to this accident, and the operator ought to exercise extreme caution in his dissections in all operations in the vicinity of the heart; and in cases where, from the nature of the operation, there is more than usual danger of wounding a vein, an assistant should compress the endangered vein on the proximal side of the point at which the incisions are made into the integuments, so that, should it be wounded, the air would not be able to enter the vessel, which may be ultimately tied so as to remove the chance of further danger.

I do not perceive that much advantage can be derived from bleeding in a case where air has entered a vein; for if this be done with the object of removing the air from the auricle, phlebotomy must be performed on a vein near the heart, and under the influence of the diastole and systole of that organ; there would then be danger of a fresh quantity of air gaining admission, and so the danger would be increased rather than diminished. In addition to this, the loss of blood would diminish the power of the heart to propel the blood through the pulmonary capillaries, and so maintain the very condition which is generally looked upon as the cause of death in this accident. The latter objection is also equally applicable to arteriotomy; for if the mixture of blood and air cannot pass through the lungs, arterial blood cannot be conveyed to the left side of the heart, and therefore the opening of an artery could be only productive of mischief by depriving the brain of the small quantity of arterial blood that could, under the existing circumstances, be conveyed to it. If, unfortunately, air should gain admission to a vein in a surgical operation, or from any other cause, the first thing to be done is to compress the wounded vein, to place the patient in the recumbent position, dash cold water in his face, support respiration by artificial means, to apply warmth and stimuli—such as sinapisms, &c.—to the surface of the body, hold ammonia to the nose, and give it internally mixed with wine, if the patient be capable of swallowing. If the quantity of air be sufficient to maintain the distention of the right auricle, I believe death will be instantaneous. If the quantity be not so great, the heart may be still capable of propelling it through the pulmonic capillaries; the effect would then be less rapid, but it would still doubtless be fatal. If the quantity of air admitted be still less, the vital power may be sustained until the capillaries have sent the blood through the lungs to the left side of the heart, under which circumstances the patient may recover.

LECTURE LXIV.

NEURALGIA.

Neuralgia—Difficulty in tracing its origin and character—Various in form—Sensatory function of the nerves affected—How sometimes symptomatic of distant disturbance—May occur in any part of the body—Neuralgic diathesis—Tic douloureux—Its supposed causes—Symptoms—Treatment.

There is perhaps no class of diseases in which the medical practitioner experiences so much difficulty in tracing the evidences of a morbid condition to some definite cause as in those belonging to the nervous system. Even when death follows as the immediate consequence of diseases which can only be referred to the nerves for their seat; in many cases no alteration of structure, no appearance of any kind of lesion, can be discovered, sufficient to explain in the slightest degree the pathology of the affection. The subject of nervous disorders is rendered still more difficult from the fact, that we know nothing of the nature of the nervous influence itself, nor of the manner in which the nerves perform their function in a state of health, as the structure of the nerves, unlike that of certain other tissues, does not in any way inform us respecting their action.

The forms of nervous disease are very various, and the symptoms by which alone they are recognisable often most incongruous; sometimes symptoms which arise merely from hysteria or some other nervous affection, simulate so closely those which are indicative of organic disease of the gravest character, that the utmost skill and sagacity are necessary on the part of the surgeon to enable him to distinguish the true nature of the disorder. Although the list of these nervous affections comprehends many which differ very much in their character, those that come, properly speaking, under the care of the surgeon are but few. Of the most terrible of these nervous disorders, tetanus, I have already given you a detailed account in a former lecture, and as most of the others, as chorea, hysteria, paralysis in its different phases, epilepsy, &c., belong exclusively to the province of the physician, it only remains for me to direct your attention to the disease termed neuralgia. In the disorders I have mentioned above it must be remarked that it is the motory function of the nerves which is affected, and the powers of the mind are in many cases greatly disturbed, and in some quite destroyed. The function of sensation is also more or less modified, but it is generally diminished, sometimes to such an extent that complete numbness and insensibility to pain are produced. In the peculiar form of nervous disorders which we have now to consider, the motory function is unaffected, neither does the mind present any evidence of being involved in the disease; an extraordinary exaltation of the function of sensation is the great feature of these disorders, and pain is their prominent, and indeed almost only symptom. It is extremely difficult to ascertain the true nature of neuralgia; the parts in which the pain is seated seldom present any remarkable appearance which can be traced to the disease, and the examination after death of the nerves which seem to have been affected points out in but few cases any organic change or temporary morbid condition to which the pain could be ascribed. Sometimes the origin of the pain, when it arises idiopathically, is probably in the portion of the nerve in which the pain itself is felt; but I think more frequently the pain is merely symptomatic of irritation existing at a distance, and experience shows us that in certain visceral disorders it is common for the pain, which is one of their peculiar symptoms, to be referred to the extremities of the nerves which are directly or indirectly connected with the part; in stone in the bladder, for example, a characteristic symptom is pain and irritation at the extremity of the penis, and in diseased hip-joint the pain is most frequently felt on the inside of the knee and not in the diseased part itself. Cases have been known in which mechanical lesion of the trunk of a nerve has been followed by such severe neuralgic pains in its filamentous terminations as to compel the sufferer to submit to amputation of the limb. Most frequently perhaps the origin of these nervous disorders is more deeply seated, and, in all probability, they proceed from organic or functional disease of the brain or spinal chord. It is a remarkable circumstance, that however severe the pain may be in a particular locality, there is seldom any indication of local action, seldom any appearance of inflammation, or, at least, not until the pain has continued for a very long period: this teaches us, I think, to look to the origin or trunk of the nerve, or to seek for some constitutional cause as the source of these pains; but the most patient and careful investigation of all the circumstances, symptoms, and history of the case will often fail to furnish a clue to the cause of the complaint, and, as I have before remarked, examination of persons who have died from nervous disease generally throws no further light upon the nature of the morbific action; pain and nothing but pain seems in most cases of neuralgia to be the characteristic symptom, and at the first view would often seem to constitute the entire complaint, consequently it usually happens that the surgeon has no guide to any deep investigation of the case. These pains may occur in any part of the body, they generally follow in the track of, or, at least, have their seat in immediate proximity to, some important nerve. The most common form of neuralgia is that which occurs in the facial branches of the fifth pair of nerves, and which is termed tic douloureux. Pathologists have divided the causes of neuralgia into constitutional and exciting, and have thought that any general disease or even tendency to a diseased condition may become a cause of neuralgia. My own experience of this complaint leads me to believe that there exists in some individuals a peculiar state of the constitution which may, I think with propriety, be regarded as a neuralgic diathesis; and which is something more than what is usually expressed by the term nervous temperament: every medical practitioner must have remarked the high degree of nervous sensitiveness manifested by some patients in comparison with others; the operative surgeon particularly has constant opportunities of observing this fact: the difference in the expression of pain in patients undergoing an operation is remarkable, some appearing to experience but slight pain even in severe operations, while in others the least incision seems to be productive of positive agony. Such an impressionable state of the nervous system, if I may use the expression, must necessarily render the individual particularly accessible to attacks of neuralgic pain from any exciting cause; hence it happens, perhaps, that writers on this complaint have not hesitated to attribute it to almost every disease to which the human frame is liable; but it is, I think, a great mistake to attribute neuralgia to any other disease as its proximate cause; it appears to me that general or local diseased action can only operate as a cause of neuralgia by primarily reducing the vital power of the patient and consequently producing that depression of the nervous system which renders it susceptible to any abnormal influence.

The causes of tic douloureux, like those of nervous disorders generally, are, in almost all cases, beyond our reach, and although some pathologists have stated, that they have been able to detect appearances or conditions of the nerve sufficient to account for the morbid action, I believe that such appearances and indications have generally had no other existence than that which they derived from the imaginations of their supposed discoverers; the great majority of observers have in most instances failed to trace out, in connexion with neuralgia, any organic lesion that could explain, or in any way account for, the violent symptoms characteristic of the disease. It has been thought by some that tic douloureux depends upon a vitiated state of the digestive system, and indeed it is not uncommon to find patients who are suffering from this disorder presenting all the symptoms of imperfect digestion; at all events tic douloureux seems most frequently to take its origin in some peculiar condition of the system at large, and not to exist as a merely local disease: many cases have been observed in which a temporary attack of the pain has been evidently induced by functional disorder of the stomach, as by the generation and presence of an undue quantity of acid in that organ; in such cases the administration of a dose of alkaline medicine was sufficient to remove the attack. Abernethy was of opinion that disordered digestion and a depressed state of the nervous system were to be found in most cases of tic douloureux, and that it may often be cured by treatment directed entirely to the improvement of the organs connected with the digestive and nervous systems. The constitutional causes of tic douloureux are nevertheless very obscure; at the same time we may, as a general principle, consider it as an asthenic disease. Ordinarily we meet with it in feeble, irritable, and depressed constitutions, in which there are strong symptoms of debility and want of nervous energy; occasionally, however, it may attack individuals in whom there is a tendency to plethora, and instances are related in which tic douloureux has preceded a fit of apoplexy. Tic douloureux is, however, far more usual in broken-down constitutions, in which the vital power is diminished either in consequence of excess, advancing age, or natural weakness. Females are said to be more liable to the disease than males, at least to that form of it which attacks the face and head, and it is a curious circumstance, that statistical accounts of the disorder indicate a different epoch in the ages of the male and female at which they are respectively most subject to its attacks, that for women between 20 and 30, and for men between 30 and 40; while children are very rarely attacked by it.

Tic douloureux is considered by some authors to be hereditary, and, *à priori*, it seems only reasonable to allow that if the peculiar diathesis or temperament most suitable for the development of gout or rheumatism can be transmitted from generation to generation, that, favourable to the attacks of neuralgia may in like manner pass from parent to child; it is notorious for tic douloureux and rheumatism to be associated, and some have supposed that neuralgia is nothing more than rheumatism of a nerve or its neurilemma, and in the latter case, that the effusion causes the pain by pressing upon the nerve itself. When tic douloureux occurs in an individual of a rheumatic temperament, it is said to alternate with the rheumatic pain in the fibrous tissues. It is not, however, of the cause alone of tic douloureux that we are ignorant, we know as little of its nature. Larrey considered it to be chronic inflammation of the nerve; by others, as I have just remarked, it is identified with rheumatism; but these are mere speculations which have little or no real foundation.

In a constitution predisposed to the attacks of tic douloureux there is no limit to the circumstances which may operate as exciting causes of the disease; exposure to cold and damp, or to currents of cold air while the body is bathed in perspiration; damp clothes, fatigue, excitement, and mental anxiety; disease of the antrum, carious teeth, mechanical lesion of a nerve by puncture; laceration or its inclusion in a ligature; irritation arising from an abnormal condition of the viscera, as the stomach or intestinal canal; the presence of worms, hæmorrhoids, or any mucous irritation, may all prove the means of bringing on an attack of tic douloureux; but the question arises whether the effect is produced by an immediate action, or by reflexion, as it were, from the nervous centre from which the nerve springs.

Malaria is probably another frequent cause of tic douloureux, particularly of that form which assumes the periodical or intermittent character; but, after all, the action of malaria is simply, I presume, that of lowering the constitution generally, and thus, if there be originally a tendency to neuralgia, establishing a condition favourable to its development. Among the exciting causes of tic douloureux, those which alone come directly under the investigation of the surgeon, and which alone have a definite character, are the mechanical or organic lesions of nerves, which in many instances have been known to be productive of neuralgia: these lesions may arise spontaneously, as in pressure upon a nerve by tumours formed either in its own substance or in the neighbouring structures, as aneurism or exostosis, or from thickening of bone, in which are situated the canals through which the nerves pass, or from the formation of bony deposits, as in the well-known case of the late Dr. Pemberton, in whom there was thickening of the whole of the frontal bone, and a deposit of a spiculum of bone near the crista galli.

Every operative surgeon is aware of the tendency which exists in some individuals, for the truncated extremities of the nerves after amputation to assume a bulbous character; nerves in such a condition are often the seat of the most acute neuralgic pain, so much so, that it is sometimes necessary to amputate a further portion of the limb to relieve the patient. I once had a remarkable case of this kind. A girl who had been formerly under the care of Mr. Tyrrell, came into Guy's Hospital, with violent neuralgic pain in the stump of an arm which had been amputated; the girl had some time before fallen down and injured her wrist severely, so much so, that the forearm was obliged to be amputated; after the amputation, the truncated extremities put on the bulbous form, and became at the same time the seat of acute neuralgia; the pain was so insupportable, that the forearm was amputated a second time, with no better result, however, than at first; the nerves again became bulbous, and the pain as bad as before. Mr. Tyrrel then removed the arm above the elbow, and the patient left St. Thomas's Hospital in the belief that she was quite cured; in about six weeks the cicatrix again became painful, and indicated a return to the former condition. At this time the girl came into Guy's, she suffered dreadfully, and it was determined to remove the stump at the shoulder-joint. I accordingly performed this operation, and with perfect success—the neuralgia was completely cured, and five years have passed since the operation without the pain having in the slightest degree returned.

Mechanical injury to a nerve may operate as an exciting cause of tic douloureux. Dr. Denmark describes the case of a sailor who was wounded in the arm by a musket-ball; the wound healed, but the arm became affected with excruciating neuralgia; the pain was so excessive and obstinate, that at length the limb was amputated, when it was discovered, on examination of the nerve, that a small fragment of lead had been detached from the bullet, and had become imbedded in the substance of the nerve. I remember having read of another case in which a violent and persistent tic douloureux was cured, after twelve or fourteen years' continuance, by extracting a small piece of china from the cheek. In tic douloureux arising from constitutional causes, it is a curious feature that the pain may leave one locality and appear suddenly in another. Cases have been known in which an attack of neuralgia is said to have alternated with aberration of intellect.

Although neuralgia may attack any part of the body, it is certainly by far most commonly seated in the divisions of the fifth pair of nerves. Tic douloureux may accordingly, with propriety, be divided into frontal, infra-orbital, and maxillary neuralgia.

The symptoms of tic douloureux are so strongly marked and characteristic, that the diagnosis is always easy; the pain is described as being very peculiar and acute; it appears suddenly in a nerve, following its course like the passage of a burning substance drawn along the part, and proceeding from towards the root of the nerve to its termination. Sometimes the pain is shooting, and sometimes shooting and burning at the same time: it is not increased by pressure, but is sometimes even relieved by it, and the paroxysm is often followed by a sense of torpor and pulsation of the part; prickings and twitchings occasionally accompany the pain, but they are more rare symptoms; the characteristic is the manner in which the pain follows, and indeed confines itself to the nerve and its ramifications, avoiding the neighbouring parts. Generally speaking, as I have stated before, there is no local indication of vascular action nor of effusion, and this is a very remarkable circumstance; but when the pain has been long continued, some slight appearance of inflammation may be discovered. It is a common symptom, that after the pain has abated, the patient passes a quantity of clear, pale-coloured urine, containing a preponderance of the earthy phosphates. I have mentioned that the pain in tic douloureux generally commences suddenly, without any preliminary warning; such is not always the case, however; a kind of shivering and a sensation of cold in the part is the prelude to the attack in some instances. Sleep seems to check the pain of tic douloureux for the time being, and I remember a patient who suffered most terribly from this disease, telling me that he never remembered having been awakened by the pain. This complaint often assumes a periodical type, but the paroxysms are even then subject to variation in their return, for in all the forms of the disease, the paroxysm may be excited by external influences, often of the most trifling character; a draught of cold air, sudden agitation, a slight touch of the part, or the motions of the face in the act of eating or speaking, may, any one of them, be sufficient to induce a return of the pain. Tic douloureux may be distinguished from rheumatism by the suddenness with which the pain comes on, by the plunging, burning nature of the pain, by the intermissions of greater or less duration, and by the complete absence of any constitutional symptoms. It may be known from the toothache by the manner in which the paroxysms suddenly cease, leaving the patient quite free from pain, and by the pain following the track of the nerve, and maintaining a kind of superficial character.

The remedies applied in cases of tic douloureux have, I fear, been generally employed too much in the character of specifics; now it is clear to me that this disease, when once established in the constitution, must be greatly modified in its nature, independently of the cause which excited it in the first instance, by the peculiar condition of the constitution itself; it is very important to bear this in mind, as it certainly ought in some measure to regulate the choice of the remedies to be employed. In the treatment of tic douloureux, the first thing to be done is to ascertain, if possible, the source of the disorder; this, as I have already pointed out, may consist in some functional disturbance, in mechanical lesion of a nerve, or in an organic affection of the brain or spinal chord: if the pain arise from functional disturbance in any of the viscera, or from mechanical lesion of a nerve, its cause may be generally traced out by careful inquiry, or may be indeed at once obvious by examination of the part in which the pain is felt. If the cause appears to be constitutional, the peculiar nature of the disturbance should be ascertained as far as it can be, and the remedies chosen which are most likely to restore or improve the state of the organs which are disordered; where, for example, the tic douloureux appears to be merely symptomatic of a deteriorated state of the digestive system, of course it would be useless to apply topical remedies in the hope of removing the pain; such a mode of proceeding would be irrational, as the pain is only a symptom of an abnormal state of deeply-seated organs, and can only be expected to cease when those organs are restored to their natural condition. Instead, therefore, of paying attention to the pain itself, the measures of the surgeon should be taken with reference to the digestive system, and rhubarb, the carbonates of soda and ammonia, with gentian, or any other vegetable bitter, are indicated. Hydrocyanic acid is also frequently found serviceable, and in one case of severe neuralgic pain of the third division of the fifth pair of nerves concomitant with pyrosis, I found that the oxide of bismuth removed at the same time the disease of the stomach and the consequent neuralgic affection. When tic douloureux accompanies rheumatism, or occurs in persons of rheumatic or gouty diathesis, the remedies which have been found useful in those diseases ought to be employed, and there is little doubt but that in such cases colchicum or gum guaiacum would produce benefit. When the disease assumes the intermittent character, as is not, I believe, unfrequently the case, when it is the consequence of miasmatic influence, quinine and arsenic are the tonics which, beyond question, produce the best effect. Added to this, however, such general treatment may be adopted as would be most likely to restore the constitution when reduced in the peculiar manner which is attributable to the action of malaria. Tic douloureux being most frequently met with in individuals in whom the vital power is at a low ebb, the nervous system generally being below its natural standard, the carbonate of iron is a remedy of the highest value; in an anæmiated state of the system, particularly, the carbonate of iron is useful as a remedy for tic douloureux, as it increases the quantity of red blood, and seems to operate more directly upon the nervous system than any other tonic; at the same time, the condition of the digestive system, and the state of the bowels, must be attended to, or the iron may produce more harm than good; and I may remark here, that before the carbonate of iron, or indeed any other tonic, is prescribed, the tongue should be perfectly clean from the previous use of purgative remedies. In choosing the system of treatment to be adopted in neuralgia, regard must be had to the peculiar state of the patient's constitution; if, for instance, he be of full plethoric habit, it may be proper to begin by antiphlogistic means before the more specific treatment be adopted; on the other hand, if the patient be asthenic, it may be necessary to adopt general measures to improve the health, such as change of air and tonics, and afterwards the administration of remedies to any particular functional disorder which may be present.

When, after having tried all such remedies as suggest themselves as likely to remove any constitutional cause of the pain, without success, it will be right to attempt to relieve the sufferings of the patient by the employment of local means of treatment. When the pain has remained obstinately defiant of every remedy, division of the nerve itself, between its origin and the point where the pain is felt, has been recommended, and in some cases has proved sufficient to remove the disease. I had a case some years ago, which Mr. Dalrymple saw with me, in which I divided the supra-orbital branch of the fifth pair of nerves. My patient was a stockbroker, living at Brixton; he suffered fearfully for a long time, and every kind of remedy and plan of treatment had been tried unavailingly. I consequently determined on dividing the nerve, and in this case with perfect success, as the pain was entirely removed, and never recurred. I believe, however, that there are but few cases in which division of the nerve will prove of any service; excepting when the nerve has been injured, or undergone any local organic change which would account for its being the seat of acute pain, when it may be beneficial to cut it off from its connexion with the nervous centres, and it is only reasonable to expect that the pain would then be destroyed; but if the pain cannot be traced to any ostensible cause, but appears to arise idiopathically from some peculiar state of the nervous system, such a mode of treatment can, I think, promise but little hope of success. Local applications will sometimes be found useful in allaying the pain in tic douloureux; belladonna, aconitine, opium, and perhaps some other narcotic or sedative preparations, will produce this effect. The aconitine seems, however, to act far most powerfully, and in a great number of cases has entirely and permanently removed the complaint; it is used in the form of ointment, one grain of the aconitine being mixed with a drachm of cerate.

In the account of neuralgia which I have now given, I have almost entirely directed your attention to the form of the disorder which attacks the nerves of the face, and I have done so advisedly, considering this as the best type of the disease; it must be remembered, however, that any sensitive nerve may be thus morbidly affected, as, for instance, the dorsal nerves, in which case the region of the chest, the upper extremity, the mammæ, or intercostal muscles, may be the seat of neuralgic pain. When the disorder lies in the abdomen, pelvis, or lower extremity, it is referred to the lumbar nerves, and so on throughout the whole nervous system, no portion of which is exempt from the attacks of the complaint. One point must not be forgotten; the great sympathetic nerve is liable to become implicated in all these organic lesions of nerves. To describe all the varieties of neuralgia would be for me a useless task; the same features distinguish the disease in all its phases; and I believe that the treatment I have laid down is equally applicable to them all, with perhaps some slight modification arising from peculiar constitutional or local circumstances.

LECTURE LXV.

TUMOURS.

Definition of the term—Classification of tumours—Tumours of the cuticle—Corns and warts—Sun-wart—Tumours of the cellular membrane—Steatomata—Their structure—Diagnosis sometimes difficult—Extirpation of steatomata—Treatment—Complication with malignant disease—Cases—Muscular tumours—Existence doubtful—Diseases of muscular system generally the effect of contamination from other structures—Case—Encysted tumours, their origin—Varieties of—Mode of removing—Cases.

By the term tumour is meant an unnatural growth or swelling; it may therefore be applied to the effusion of lymph, the formation of matter, or to an unsymmetrical enlargement of any part of the body, whatever the cause of that enlargement may be. Some surgeons, however, have attempted to render the term more exact, and have defined a tumour as a circumscribed swelling produced by disease, and differing in nature and consistence from the structures whence it arises. But this definition will only apply to certain kinds of tumours, for neither steatomata nor exostoses differ from the tissues from which they take their origin, and constitute rather hypertrophy of those structures than a distinct abnormal growth. A tumour may be more correctly defined to be an unnatural enlargement or morbid growth not included in the original structure of the body. The causes of such adventitious growths are extremely difficult to discover, and may be either local or constitutional. John Hunter promulgated the opinion that blood effused from external injury became coagulated, its serum absorbed, and the remaining fibrin subsequently organized from the extension into it of surrounding vessels. But when we observe how frequently effusions of blood occur without the formation of abnormal growths, such a doctrine appears to be scarcely tenable, particularly as tumours often present at their very commencement as much variation from the surrounding natural structures as after they have become extensively developed; and even when traced to the earliest period of their growth they do not present the characters of organized fibrin. It seems that from any cause which induces inflammation in a structure, whether that cause arise from disease or external injury, such a deviation from the natural nutrition of the part may take place as to induce a morbid growth, which, although it may be similar to the structure from which it emanates, still generally sufficiently differs from it, to constitute disease rather than mere hypertrophy; tumours should therefore, I think, be classified according to the tissues whence they arise, rather than according to their own physical conditions, as it will always be found that the effused mass constituting the tumour resembles more or less the structures in which it originates, but existing under an altered form.

From increased local action an effusion of blastema takes place to a greater or less degree, and under normal circumstances is speedily converted into tissue similar to that in which it is deposited; if, however, any force be in operation sufficient to alter the condition of the formative cell or exudation globule, the capillary vessels which are to supply it, or the surrounding tissue, the natural growth of the cell would probably be interrupted and an abnormal development be the consequence. When the defect exists in the cell itself, the latter may go on increasing in size without being converted into tissue, maintaining its existence as an isolated growth. Under these circumstances the capillaries which supply the part may secrete serum, converting the enlarged cell into a simple sero-cyst, or the nuclei of the original cell may each produce a separate cell, and then a serous tumour, composed of numerous cysts, is formed. In some peculiar constitutions blood corpuscles may be thrown out with the serum, a sanious effusion being then produced; in more vigorous constitutions a preponderance of albuminous matter may give to the fluid contained within the cyst greater consistency, modifying the physical condition of the swelling, which is then made to approach more nearly to the character of a solid growth. The conditions I have recited above may occur in any tissue or in any part of the body; when the cyst is once formed its presence may stimulate the nutritive vessels of the tissues in which it is placed, so that hypertrophy of the part is produced, and the tumour will then be composed both of the original cystiform morbid growth and the tissue in which it is imbedded, and which, if it preponderate, often gives a peculiar character to the tumour, according to the nature of the particular tissue affected. A further change may still take place in the tumour; the cyst, which we have hitherto viewed as containing only a fluid, or only solid matter derived from the natural fluids, may now become capable of throwing out growths from its internal surface; these growths are various in character, being even sometimes fungoid; the solid growth thus formed from the inner wall of the cyst may go on growing more rapidly than the cyst itself is developed, and ultimately filling the latter, the appearance of the cyst is lost, the whole being converted into a solid mass. Cysts are likewise sometimes formed from the obliteration of the excretory canals of a secreting apparatus, they may therefore be produced alike from the most simple follicle and from the most complicated gland tissue. Sir Astley Cooper was the first who gave any account of the pathology of the small subcutaneous cysts which frequently form in different parts of the body, especially in the scalp and shoulders; he observed that with a magnifying glass he could invariably detect a small opening capable of receiving a punctum probe, and that by pressure the contents of the sac could be squeezed out of the opening just as in the disease termed acne punctata. Sir Astley attributed the formation of these tumours to some obstruction of the follicle which prevented the exudation of its contents, and as this went on accumulating a distention and increase of bulk in the sac were the necessary consequences; this he believed to be the origin of all encysted tumours, even in the breast or any other secreting gland. If excretory ducts become obstructed they are likewise liable to distention by being filled with the products of the secreting gland, constituting a cystiform tumour after the manner I have described above. The interior of these cystic tumours is invariably lined with epithelium; this forms indeed one of the characteristics of these tumours: but when the sac is removed from the body, perhaps the only means of knowing from what part it was removed is by examining the contents of the cyst; this may indicate the kind of organ in connexion with which it had grown: for example, more or less of the constituents of milk would perhaps be found in a cyst from the breast, or of bile in one from the liver. With the nature of that form of cystic growth which I have spoken of under the view that it is produced from the abnormal development of a formative cell into a cyst, Sir Astley Cooper seemed to be unacquainted; and we cannot be surprised at this, when we consider that the microscope at that period had scarcely been called in to the assistance of the pathologist; but with respect to the physical conditions and peculiarity of appearance these cystiform tumours present, no better or more accurate description has been given than that by Sir Astley Cooper.

Tumours, after they have acquired a certain size, frequently induce an irritation in the surrounding tissue, which leads to the formation of a kind of cyst or capsule, more or less distinct.

These must not, however, be mistaken for the true cystiform tumours already described, as in this case the capsule is formed only of the condensed surrounding tissue, and constitutes no portion of the disease, being indeed apparently a means adopted by nature to isolate the diseased structure from the neighbouring healthy tissues.

Mr. Abernethy has attempted a classification of tumours according to their internal structure and organization, placing them under the general heads of sarcoma and cancer, dividing the former into adipose, pancreatic, mammary, and tuberculated, and the latter into scirrhus and fungus hæmatodes, or, as he sometimes termed it, medullary sarcoma.

In the present state of our knowledge respecting the structure of tumours it is very difficult, nay I believe impossible, to make a classification of these morbid growths which would not be subject to serious objections. Dr. Warren of Boston has adopted, in his excellent work on this subject, a classification which has many advantages, but which at the same time is liable to be cavilled at in some respects. He proposes to classify tumours according to the textures or tissues from which they spring: as I have just said, it does not meet all the difficulties of the case, but I believe it to be the best arrangement hitherto attempted. It may be said that it is often impossible to ascertain in what tissue a tumour really commences, and a classification of tumours according to this plan places in one group tumours of any kind without regard to their character, or whether they are malignant or non-malignant; in addition to this, many tumours are not strictly confined, as to their origin and development, to one particular tissue, as, for instance, encysted tumours and fungoid growths, which may both of them occur indiscriminately in any of the structures. These objections are quite valid; but although it is generally easy enough to find weak points in a system, it is not so easy to find a new one sufficiently good to take its place. The great question here is this: does this arrangement or classification facilitate our diagnosis of tumours? if so, it is beneficial; and as I believe such to be the case, I have determined upon adopting it. With respect to the diagnosis of tumours, it may be said that their physical appearances—such, for instance, as their form, colour, and consistency, and the history of the case, with proper consideration, at the same time, of the constitution of the patient—will do more for the surgeon in enabling him to judge of the nature of the swelling than any classification, however exact. I shall follow the arrangement of Dr. Warren on another point: I shall begin with the tumours of the surface. I have already described a variety of tumours of different kinds in connexion with the regions of the body in which they occur most frequently; in this lecture I shall confine myself to those morbid growths which affect no particular region of the body.

Tumours of the cuticle.—These comprehend corns, warts, and those singular horny growths which have been seen in some individuals. A corn (clavus) is an indurated substance generally formed in consequence of pressure over a joint of the foot, between the toes or in the palms of the hands: when it is situated between the toes, where it is kept moist by the perspiration, it is soft, and is then known as a "soft corn." Sometimes these corns are attended with a great deal of inflammation which seems to exist in the cutis beneath the corn; they are then very painful, and cause considerable distress to the patient; a poultice, bathing the foot in warm water and keeping it at rest, will generally soon relieve the inflammation; to cure the corns the foot should be frequently bathed in warm soap-and-water, all pressure should be removed, and they may be filed down or carefully picked out. Corns are more frequent in females than in males, and probably most so in the higher classes of society.

The common cuticular wart is an inoffensive excrescence which occurs not unfrequently upon the hands and other parts of the body in young people; they are productive of but slight inconvenience and do not pass into any more serious form of disease: they often disappear spontaneously, and may be readily removed by excision from their cuticular attachment, or more slowly by being frequently touched with nitric acid or lunar caustic. There is a species of wart of a much more important character than this, and to which West Indians seem to be particularly liable—it is termed sun-wart. In its first appearance it constitutes merely a trifling desquamation of the cuticle, it then becomes warty: if forcibly removed, a slight abrasion of the skin is left, whence a secretion exudes which has a great tendency to harden and form a scab. If this be again removed, the sore becomes larger, and an ulcer is established; but if the eschar be allowed to remain, it defends the cutis from the influence of external agents, and by the assistance of alterative remedies the wound cicatrizes under the scab, and the disease is consequently removed; but if the outer crust be rubbed off before the cicatrization is complete, the ulcer soon assumes a phagedænic character, and rapidly increases. At this period of the disease, chloride of zinc should be applied, and a small quantity of charpie placed over the ulcer: this soon forms a hard crust, and should be kept on the surface until it spontaneously falls off, when the wound beneath will generally be found healed. A good preparation for producing a similar curative effect is a mixture of lime and potassa fusa made into a paste with alcohol. This is to be spread on a piece of lint, and laid over the sore; the whole may then be covered with the preparation termed collodion, and left until it spontaneously falls off.

As I have remarked in a former lecture, this disease is very similar to chimney-sweepers' cancer; its virulence seems to depend upon the frequent irritation arising from the removal of the scab, just as in chimney-sweepers' cancer the sore is constantly irritated by the soot. Sometimes, however, in strumous diatheses, or in persons who have been many years exposed to a tropical climate, the functions of the skin become so much impaired that it is incapable of maintaining a healthy action, and the ulceration continues until a large portion of the face is eaten away. At the same time it may be questioned whether this is to be classed with malignant diseases, as it is not liable to be propagated by the lymphatics, but appears always to remain as a local affection only.

These diseases are the result of an altered condition of the true skin; for as the epidermis is merely a secretion from the skin, and is quite inorganized, it cannot in itself engender an abnormal condition, or give rise to morbid growths.

Tumours in the cellular membrane.—Steatomata or fatty tumours are the most frequent morbid growths that occur in this tissue; they acquire sometimes a considerable size, which often leads to the necessity for their extirpation. Some persons seem particularly liable to the formation of these tumours: this would lead to the belief that they depend upon some constitutional tendency rather than upon any accidental local cause, as I have never been able to trace the formation of a steatoma to external injury. The formation of fat, moreover, always seems to arise from a kind of degeneration of tissue, and on that account must be regarded as depending upon an altered condition of the constitution. These adipose tumours are very slow in their growth, causing little or no pain, even when they have acquired a very considerable size. Their physical condition is recognisable by their doughy feel, lobulated form, great mobility, close proximity to the skin, and from the skin itself retaining its normal appearance. If the tumour be pressed so as to tighten the skin. its lobulated form becomes quite distinct, and the freedom from pain during this manipulation constitutes a further diagnostic mark. In some patients several of these fatty tumours are found simultaneously existing in different parts of the body;

I had lately a female patient in the hospital who had eight, three of which weighed at least three pounds each: one of them I removed from the upper arm in consequence of the inconvenience it caused her.

Steatomata consist of masses of fat enclosed in fat cells, and generally when they acquire any size they produce a thickening of the surrounding cellular tissue, which forms a capsule of greater or less density around the whole swelling; the lobulated form probably results from the distention of the cells of the adipose membrane, which are sometimes so distinctly separated as to give to the tumour when removed somewhat the appearance of a bunch of grapes. If the fat be soft in consistence, it is more diffused, and its lobulated appearance much less distinct; I have met with steatomata, the contents of which were so soft as to give almost the sensation of fluctuation, and which might therefore have been mistaken for abscess. When the fat is deposited immediately beneath the skin and subjected to much pressure, the lobes are much smaller, and even sometimes granular, and the cysts proportionally thicker and stronger: such steatomata are more firmly fixed, and consequently removed with more difficulty when their extirpation is had recourse to. Sometimes steatomata assume a pendulous form, adhering by a narrow neck, as if a few of the adipose cells only were subject to the abnormal growth of fat, the tumour extending itself outwards, as if the enclosing cyst were capable of generating fat in the direction of its length rather than its breadth, forming a long pendulous tumour with a narrow neck. In extirpating these tumours care must be taken not only to remove the external swelling, but also to extract the quantity of fat subcutaneously situated. It is not unfrequent to find rather a large branch of an artery running through the neck of such a tumour into the cyst, by which the fat, in fact, becomes generated beyond the normal influence of the capillaries of the original adipose membrane. In the removal of steatomata of this form, more than usual hæmorrhage may be expected from the manner in which the cyst is nourished.

In removing a steatoma a free incision should be made through the skin to expose the outer capsule of the tumour: this capsule is next to be cut through, when generally the mass of fat may be turned as readily out of its cyst as a kidney may be drawn from its capsule. It rarely happens that any difficulty occurs in checking the bleeding, but the wound should never be dressed until the hæmorrhage has perfectly ceased: the cavity becomes otherwise filled with blood, and the union of the wound by adhesion will certainly be prevented. When dressed, the edges of the wound should be closely adapted and retained in their position by one or two sutures: a compress of lint should then be laid over the cavity, and slight pressure maintained by bandages. It is not always that these tumours are so readily extirpated, for if by exposure to pressure or external violence they have been subjected to inflammation, they may adhere so firmly to their capsule as to require the dissection of the latter from the surrounding cellular connexions: in this case the period required in the operation would be much protracted. I have never known the disease return after its extirpation, nor have I ever witnessed what is described by some surgeons—viz. that the stimulus of the operation leads to the formation of these tumours in other parts of the body, even where there had been no previous apparent tendency to their formation. Indeed, I do not know of any surgical operation which promises a more favourable result, and have never known any untoward symptom occur excepting when the size of the tumour renders so large an incision necessary that a comparative degree of constitutional irritation must naturally result. Erysipelas, also, sometimes supervenes, in this, as in other operations.

Steatomata are liable to undergo certain internal changes or deteriorations, by which their condition becomes much modified; like normal tissues, they sometimes inflame, suppurate, and ultimately slough. And cases have also been known in which calcareous matter was deposited in the substance of steatomata. If subjected to pressure from being placed beneath a fascia, or from the influence of muscles, these growths also become at times so much indurated, that the diagnosis is rendered difficult.

Steatomata from their position may sometimes be mistaken for tumours of a totally different character and class. The following case affords an example of this:—

John Baldwin, aged 24, was admitted May 25, 1841, for a large tumour in the gluteal region. He stated that about nine or ten years before, he first discovered the existence of the tumour, which had even then acquired considerable size; it gave him no pain, but continued to increase so rapidly, that he consulted at the time Dr. Lubbock, of Norwich. Upon examining the swelling, I observed an elliptical cicatrix, which the patient explained to me had been made by Dr. Lubbock in an attempt to remove the tumour, but which he had abandoned from the fear that it communicated with the interior of the pelvis. After strict examination I determined upon its removal, and consequently extirpated it on the 28th of July. The operation was performed in the following manner:— The patient was placed in the prone position, and an incision three inches long made over the tumour. The several layers covering the swelling which lay beneath the gluteal muscles were successively divided, and the nature of the swelling became at once apparent—it was a large steatoma. It penetrated into the great sciatic notch, and had a firm attachment to the sacro-sciatic ligaments and pelvic fascia, its connexion with the latter accounting for its motion in coughing, which probably had led Dr. Lubbock to form a wrong diagnosis. The tumour weighed upwards of four pounds, and was entirely composed of fat of different degrees of consistency, according to the pressure to which its different parts had been subjected. The patient perfectly recovered.

On the 23rd of November, 1850, Mr. Adams, of Cambridge, sent me a child of nine months old, who was born with a tumour over the anterior and superior spinous process of the right ilium, and extending somewhat into the right iliac fossa; its situation gave the idea that it might be connected with the cæcum. From the birth of the child, up to the time of my seeing it, the tumour increased rapidly, it was then about the size of a large orange. When handled, the tumour gave a sensation which resembled what may be supposed to arise from its being filled with a mixture of air and fluid; in coughing, it received so strong an impulse that I suspected a malformation of the parietes of the abdomen and the protrusion of intestine, while the fluctuation seemed to countenance the belief that it might be chronic abscess. As the diagnostic marks in this case were so doubtful, I thought it advisable to pass an exploring needle into the tumour; upon placing the contents of the groove under the microscope, I at once discovered that the tumour was a mass of fat. I removed the tumour in the presence of Mr. Adams, and as the microscopic examination had shown the nature of the morbid growth, I was enabled to remove it in ten or twelve seconds; although, without this knowledge, I must have proceeded by an exploring operation, which would have taken as many minutes.

The following is a case in which a steatomatous tumour was complicated with malignant disease:—Elizabeth Gore, æt. 41, a married woman of unhealthy aspect, was admitted into Guy's on the 26th October, 1847, with a tumour situated above the left mamma, occupying the space between it, the axilla and the clavicle. Shortly after the birth of her last child she first discovered the tumour; it caused her at the time but little pain: she had, however, been ordered to apply leeches, and a liniment had also been prescribed. Upon her admission into the hospital, the tumour extended from the sterno-clavicular articulation along the whole length of the clavicle, encroaching upon that bone, having apparently a firm attachment to it, the swelling also extending somewhat into the axilla. The feel of the tumour was lobular, especially at its lower part, and all the physical signs indicated that it was a steatoma. Upon abducting the arm the tumour was subjected to great compression from the tension of the pectoral muscle under which it was placed: this action also created considerable pain, which was of a darting character: no fluctuation could be detected, nor had the patient suffered from rigor.

The woman was suffering from a troublesome cough, and therefore the extirpation was delayed until the 25th November, on which day the operation was performed. The patient was placed on the table in the recumbent posture, her head and shoulders being somewhat raised, and the arm held from the side: an incision about six inches in length was made through the skin over the swelling, in the direction of its long axis, and in the course of the fibres of the pectoralis major muscle; the arm was then adducted, and the sternal portion of the pectoralis muscle being separated from its clavicular, the tumour was completely exposed: I next introduced my fingers to detach it from its connexions, which were extremely firm, especially to the costo-clavicular ligament, from which I was obliged to dissect it: the operation lasted a quarter of an hour; the patient bore it extremely well: a large sponge was placed in the wound, and she was put to bed; about two hours after the operation the edges of the wound were brought together, and retained by soap plaister. Considerable irritative fever followed, the wound put on a sloughing appearance, typhoid symptoms supervened, and after eight days of suffering the patient died. Upon examination of the tumour, which weighed upwards of a pound, it was found to be composed in part of lobes of fat intermixed with sero-cysts, some of which contained sanious fluid, and others medullary matter, presenting all the appearance of malignant disease. On examination of the body twenty-four hours after death, the wound and the whole region of the axilla presented an extensive sloughing surface; the left axillary vein was filled with a solid coagulum; the lungs were watery, turgid, and easily lacerable —fleshy spots, not quite devoid of air, were seen in them, of a slight dull red colour, and having rather a malignant appearance; the Fallopian tubes were free, but dark coloured; the ovaria pale and rugous; the uterus of moderate size, and firm, but the os and cervix felt harder than natural, and one part of the neck was so hard as to lead to the suspicion of malignant disease.

These cases are, I think, sufficient to illustrate the difficulties that may arise in cases of steatomata: the first and second, from their position and physical conditions, the third, from its complication with a malignant diathesis; and they show the necessity for the most careful investigation before forming either a diagnosis or prognosis.

Strumous and malignant disease of the absorbent glands may also be considered with tumours of the cellular membrane, and the extirpation of these frequently becomes necessary. The following case affords a strong example of the contamination that may extend from one part to another through the medium of the absorbents, which are so intimately connected with the subcutaneous cellular tissue.

Cornelius Sullivan, a middle-aged man, was admitted into Guy's Hospital with a malignant tumour in the left groin: some years before, he met with a severe accident to his left foot; this was shortly after followed by a swelling in the groin, unattended, however, by uneasiness, until about two years before his admission into the hospital, when the pain became at times considerable. The tumour was irregular, bulging, firm and elastic to the touch; the skin smooth and slightly discoloured; two large arteries could be felt pulsating on its inner side; it was twenty-one inches in circumference; it was pendulous, and pain was felt only at its upper part, where it was also tender on pressure. Six days after his admission into the hospital I removed the tumour: the patient was placed upon the table, and I commenced by making an incision on the outer side of the swelling, beginning at the upper part, and extending it round to the opposite point beneath. Although the incision was only superficial, three arteries bled freely, but the hæmorrhage was stopped by pressure on the mouths of the divided vessels, and on the femoral artery where it passes over the pubes; a second incision was made on the opposite side to the first, and in about five minutes the tumour was removed: considerable bleeding followed each stroke of the knife; it was, however, arrested as much as possible by the assistants making pressure with their fingers, and immediately after the removal of the diseased part eight vessels were secured, and the edges of the wound brought together by sutures and strips of adhesive plaister; a compress and roller were also applied around the thighs, to keep them in a state of adduction. The morbid mass presented a medullary appearance, and weighed, after removal, between six and seven pounds.

The day after the operation the patient complained of uneasiness in the wound, and of considerable pain in the left side of the abdomen, which was increased by pressure; on the next day the pain had become aggravated, and there was also tendency to vomit: a portion of the dressing was removed. On the 6th of March the remainder of the dressing was taken off; the wound looked quite healthy, and the general health of the patient had improved. On the 1st of April the wound was quite cicatrized, excepting at one point, where the only remaining ligature protruded; his general health was now restored: and he soon after left the hospital quite well. I have never since heard that the disease has reappeared; but as the tumour presented all the characters of a malignant disease, I should be inclined to suspect its liability to return, either in the epigastric or lumbar glands.

In July, 1836, I admitted a woman, æt. 58, who was the subject of a tumour in the upper part of the left thigh, which she had first observed three years previously; she had never had a child. In appearance the tumour was about the size of a goose's egg, somewhat lobulated, varying in hardness in different parts of its surface, but in no part fluctuating. In describing her case she brought to my recollection that I had, ten years previously, removed a small tumour from the inner side of the left knee, which I remember Sir Astley Cooper had agreed with me in considering of a malignant character. About a fortnight after her admission I removed the tumour in the thigh, and found it very difficult to detach it, in consequence of its firm adhesion to the femoral sheath, which was implicated in the disease. The attachment of the tumour to the sheath of the artery being peduncular, I cut it through, and removed the tumour, applying a ligature to the remaining portion of the peduncle, to cause it to slough off. Three vessels which had bled freely, owing to their being cut so closely to the femoral artery, required ligature during the operation, and the wound was then dressed. On the fourth day there was considerable secondary hæmorrhage, which appeared to arise from the portion of the tumour which had been left adherent to the sheath; the bleeding was, however, restrained by pressure: the wound then put on a sloughing action, and about ten days after the operation, the patient died with typhoid symptoms. The point of peculiar interest in this case is the length of time that had elapsed between the removal of the first tumour and the appearance of the second in the groin. The second tumour bore all the characters of carcinoma, some parts being softer than others, from the commencement of the ulcerative process. No part of the tumour appeared to be composed of a glandular structure, but seemed to have commenced from the cellular membrane and fibrous tissue of the femoral sheath. I could without any difficulty multiply examples of the occurrence of malignant tumours in the cellular membrane, both as a primary and secondary disease, but the two cases quoted seem to me sufficient to illustrate the fact of the capillaries of the cellular membrane being capable of depositing the constituents of these abnormal growths in peculiar diatheses.

Painful subcutaneous tumour.—This most distressing form of tumour is considered by some to be formed in connexion with nervous filaments, and to derive its excessively painful character from that circumstance. This does not, however, seem to be correct. The tumour appears to be simply fibrous or fibro-cartilaginous, enclosed in a kind of capsule or cyst. It lies beneath the integuments, and is often not externally visible; it is usually rounded in form, and seldom exceeds the size of a pea. It is said to occur sometimes in the track of a nerve or within its sheath, but it must be distinguished from the tumours of the nerves termed neuromata, and which are formed from the substance of the nerve itself. These little painful tumours are most common in the legs, but they are found likewise in other parts, as in the upper extremity, the breast, or face. This disease is more common in women than in men; it generally happens between the ages of forty and sixty, that is, when the individual is advancing in life. In some situations this disorder may be mistaken for neuralgia; but a close examination of the part will lead to the discovery of the tumour, which is often adherent to the skin, but generally loose within the cellular tissue. When exposed by dissection, it has the appearance of a somewhat hard white tubercle covered by a fibrous envelope. The pain in this disease is very great, but varying; it is generally sharp and lancinating. When the tumour is of long standing, the skin over it may inflame and ulcerate; and the ulcer sometimes puts on a malignant character, ultimately proving fatal. Generally, however, this tumour is not of a dangerous character, although the only means of removing it is excision of the part; this is quite effectual, and the disease does not seem liable to return.

Tumours in the muscular system are of very rare occurrence, and indeed the muscular system seems particularly free from disease of any kind, for even the abnormal contractions of cramp or tetanus, and the involuntary motion of the muscles in chorea, must rather be considered as the result of disease of the spinal nerves than of the muscular system itself. It is true that malignant disease, whether it commence in bone, periosteum, or cellular membrane, may secondarily affect the muscular system, but I have never seen primary malignant affection of this tissue. The only abnormal growth I have witnessed in the muscles is one of a fatty character, and which, as it is invariably indicative of constitutional deterioration, requires medical rather than surgical treatment, and it has never fallen to my lot to remove any morbid growth originating from muscle itself.

Muscles, when lacerated transversely, reunite by a structure very dissimilar to the muscular tissue, and the medium of union never possesses contractile power, although in time it acquires a degree of firmness from tension, so that it loses the physical property of elasticity, and then no longer interferes materially with the natural functions of the divided muscle. This new structure sometimes assumes externally the appearance of a tumour, and, indeed, under certain actions of the affected muscle, becomes so prominent as to excite alarm in the mind of the patient, and to deceive even experienced surgeons as to its true nature. I remember a case of this kind in which an eminent surgeon cut down upon the rectus muscle to remove one of these abnormal growths, having from its physical conditions some suspicion of its malignancy; but when the part was exposed, by cutting through the fascia lata, the swelling could no longer be observed, a species of tendinous matter was seen transversely intersecting the muscle, but it seemed upon exposure to have lost its prominent condition, probably from the tension of the surrounding parts being removed; and although there was nothing to extirpate, the abnormal projection never returned after this operation.

The muscular melanotic tumours, fungoid and encysted swellings in this system, or what are at least so designated by some authors, I believe invariably have their origin in the surrounding cellular membrane, although they may ultimately extend to the sarcolemma, with which, indeed, the muscle may ultimately become involved in the disease. I think I have seen, after an extensive deep-seated effusion of blood, a permanent solid tumour result, as if the bleeding had taken place within the sheath of a muscle, and had there become organized; but as I never had an opportunity of examining the structure of such a swelling, I cannot speak positively as to whether the fibrine of the extravasated blood has become organized, or merely remained as a coagulum. I have sometimes seen, in the extirpation of carcinomatous and fungoid mammæ, malignant deposits so intimately connected with the pectoral muscle as to render it extremely difficult to decide whether it were propagation of the disease in the muscle itself, or in the absorbent and venous systems of that muscle; I am disposed rather to consider it in the latter light, as I have always found some enlargement of a gland in the axilla concomitant with that condition;

and certainly, in practice, the adhesion of the scirrhous tumour to the muscle always constitutes an unfavourable prognostic indication.

Encysted tumours.—The most common kind of encysted tumours are those which so frequently occur upon the scalp, and which are known as wens; they contain cheesy, or atheromatous matter, and are probably formed by the obstruction of the duct of the sebaceous follicles. These follicles constitute a considerable proportion of the structure of the cutis, their function being to secrete a fluid for the lubrication of the surface of the skin: they may be considered, in fact, as the most simple kind of gland, and are composed of a small sac projecting internally into the cellular tissue, and deriving its bloodvessels from the capillaries of that structure. If from any cause the orifice of the follicle becomes closed, a retention of its secretion must necessarily follow, and exciting a morbid action, alter the natural character of the secretion; the sac becoming inflamed continues to grow, and is converted into an encysted tumour. These tumours sometimes increase to a considerable size, but more frequently remain about the size of a marble, not appearing to possess any tendency to enlargement, unless subjected to further irritation, as from the pressure of the hat, or some similar cause, when they often begin rapidly to increase, and require to be removed by operation. The formation of an encysted tumour may proceed not only from the accidental closing up of the excretory orifice of a follicle, but also in consequence of an inflammatory action, which may induce such a change in the character of the secretion, as to render it incapable of flowing from the follicle in the normal manner. Acne punctata may be considered as the simplest form of follicular encysted tumour.

In many persons there appears to be a peculiar tendency to the formation of encysted tumours, especially in the scalp. I have removed as many as seventeen from the head of one gentleman; and in another instance I removed seven from an individual, still leaving five others which did not offer any inconvenience at the time, and which I therefore thought it better not to interfere with. The best mode of removing them is by making an incision through the skin, avoiding, if possible, the opening of the cyst; which, with its contents, should be detached from the skin by a probe, and by slight pressure at the sides of the tumour it usually turns out at once. Should the cyst have become adherent from continued pressure, it may require to be dissected from its attachments by the scalpel. If after its removal the sac be opened, it will generally be found to contain atheromatous matter; and should the tumour have been subjected to considerable pressure, and inflammation have supervened, the contents may be found tinged with blood. It sometimes occurs that the sac, from the accumulation of its contents, ulcerates, the secretion is hardened by the exposure to the atmosphere, and continuing to grow, becomes converted into a substance having very much the appearance and character of horn. A curious specimen of this kind of tumour may be seen in the museum of St. Thomas's Hospital: it was removed by Dr. Roots, of Kingston, and was presented by him to Sir Astley Cooper. Upon examination of this substance under the microscope, it will, however, be found not identical with horn. Earthy matter and hair have been found within these cysts. It can, I think, scarcely be a matter of surprise that hair should be found in them, from their close proximity to the hair bulbs, whence they are likely to receive bloodvessels fitted to furnish the constituents necessary to the formation of hair. But it is curious that the hair found in these cysts is destitute of bulbs. Some surgeons have recommended that the cyst should be punctured, and its contents squeezed out; others, that a free opening should be made into it, its contents being turned out, and the sac filled with lint. This treatment sometimes leads to a morbid fungus-like growth from the surface of the cyst, and therefore extirpation is generally to be preferred. In one case, I have succeeded in completely destroying a cyst of this kind by the injection of a saturated solution of alum. A lady in Norfolk-street, Park-lane, sent for me in consequence of suffering from the irritation of an encysted tumour on the forehead, which had become inflamed from being injured in combing the hair. I ordered at first a cold white-wash poultice, to subdue the inflammation: the skin ulcerated, and a partial discharge of the contents of the tumour resulted. I wished to extirpate the cyst, but my patient would not submit to the operation; and I therefore determined upon injecting it with a solution of alum. In four or five days the cyst had become detached from its cellular connexions, and could be readily removed by a pair of forceps. I suppose that the alum coagulated the blood in its nutrient vessels, and had thus destroyed its vitality.

I should not recommend this treatment in preference to extirpation, but in cases where the patient is determinedly opposed to the operation I think it may be adopted with great advantage. I have removed pendulous tumours from the skin containing the same kind of atheromatous matter as is found in the deep-seated cyst, and believe that the tumour in that case results from the prolongation of the cyst externally. I am induced to believe this from the following case:—On removing one of these pendulous tumours from the thigh of a gentleman, and having cut through the neck of the tumour, a considerable quantity of atheromatous matter exuded from the centre of the wound, showing that a portion of the sac was still deeply-seated in the cellular tissue. The partial excision was, however, sufficient, as ten years have now elapsed, and there has been no return of the tumour.

Simple as these operations are, there is one point of great importance to be considered—this is, the subsequent liability to erysipelas, especially when the tumour is seated in the scalp, for in consequence of the freedom of the motion in this part, from the action of the occipito-frontalis muscle the frequent interruption to the adhesive process induces considerable constitutional disturbance, and therefore every means should be employed to prepare the patient before the tumour is removed, and after its removal bandages should be applied to prevent the motions of the occipito-frontalis. I lately removed an encysted tumour from the head of a gentleman, and applied collodion (solution of gun cotton in ether, as a dressing): this formed so complete a covering, and on drying contracted so much, that the wound perfectly united by adhesion in four days. The hardness of the covering provided by this substance affords this great advantage, it maintains the condition of fixedness so conducive to the prevention of erysipelas, as well as to the healing of the wound.

The contents of a cyst may be very different from what I have now described, and may indeed result from a totally different cause. In the kind of tumours just mentioned, the cyst is derived from a normally formed sac, which had undergone some change in consequence of a morbid action, but in the true cystiform growth, the disease results, as I have said before, from an unnatural condition of the blastema, or exudation corpuscle, which, instead of being converted into normal tissue, maintains its cell character, sometimes merely increasing in size, and sometimes generating new growths, generally differing more or less from the structure in which the cyst is placed; the malignant cell is somewhat of this character, different from the non-malignant cyst, however, in the circumstance that an element is produced in it or with it, which seems to act as a poison upon the blood, parasitically destroying the life of the individual affected. The contents of the non-malignant cysts are very various in their character. This depends partly upon the constitution of the patient, partly upon the tissue in which the cyst is formed, and partly upon the pressure and the physical conditions to which it is exposed. The cyst may contain only a limpid fluid, or its internal wall may take on an action whereby it becomes capable of throwing out solid growths, which may differ essentially in character, and offering points of distinction by which the surgeon may often form an accurate opinion of the nature of the tumour, and be enabled to refer it to its proper pathological class. Cystiform tumours may, according to their contents, be therefore described as serocele, hæmatocele, and sarcocele. Such a classification is doubly useful, the treatment as well as the diagnosis being regulated by a knowledge of the contents of the cyst.

I believe that encysted tumours sometimes degenerate into a malignant disease. In 1838, Mr. Steadman, of Guilford, brought me a patient, who, about two months before, discovered a small tumour in the right lumbar region: upon pressure a small quantity of atheromatous matter exuded; it soon scabbed over, but in about two months unhealthy granulations sprouted out, supported by a thin peduncle; these exuberant granulations soon acquired the size of half a crown. At this time Sir Benjamin Brodie saw the patient, and applied potassa fusa: this, however, only partially destroyed the growth. In a month after, the patient again came to London, and Sir Benjamin Brodie being out of town, I was consulted. I recommended the immediate extirpation of the disease: the patient would not consent to this, and placed himself under the care of Dr. Chambers and Mr. John Scott. In January of the same year he died, the disease having proved to be fungoid: the immediate cause of his death was, however, hæmatemesis, probably produced by the extension of the fungoid disease to the stomach; but I believe no post-mortem examination was permitted to establish this fact.

Mr. Scarr, of Bishop's Stortford, brought me, some time since, a young gentleman, twenty-three years of age, who was the subject of a tumour, about the size of a walnut, upon the back of the hand. It had been punctured in two or three places, and from the openings (which had never healed) fungoid granulations sprung: in this state I first saw it—the skin was quite flexible and easily raised from the subcutaneous tissues, proving the non-extension of the tumour into the cellular membrane. I had some fear from its appearance that the disease was malignant, and recommended its immediate extirpation: this was performed with considerable difficulty, in consequence of the looseness of its texture. Nitric acid was applied to the wound after the disease was extirpated, and it never returned.

LECTURE LXVI.

AMPUTATION.

Importance of the subject—Origin of amputation—Its progress among the earlier surgeons—Circumstances under which amputation may be rendered necessary—Difficulty of determining whether amputation ought or ought not to be performed—Reasons for deferring amputation in accidental injuries—Secondary amputation—When necessary—Cases—Non-union of fracture—Circumstances preventing union—Treatment. Tetanus—Case. Primary amputation should be performed as early as practicable—Reasons for its delay—Different methods of amputating—Preliminary considerations—Preparation of the instruments, &c.

During the war in which this country was involved for so many years, an ample opportunity was afforded to the members of the medical profession, both in the army and navy, to investigate practically every circumstance connected with such injuries to limbs, as could render amputation necessary; and many of them have added much to the science of surgery, by communicating the results of the experience derived from the peculiar situation in which they were placed.

The peaceable state of Europe for nearly thirty years has, however, not only removed this source of inquiry and improvement upon the subject of local injuries, but the length of time that has elapsed has even tended to throw into oblivion the facts which had been accumulated.

At the same time, it should be remembered that the subject has lost neither its interest nor importance; for the rapid extension of machinery has given rise, of late, to many and frightful accidents, in which the injuries that have been inflicted, though differing in their causes, are similar in nature to those occurring in military service.

The removal of limbs by amputation seems first to have been suggested by observing the process by which nature spontaneously separates a dead from a living part in the human body, the progressive steps of which are so obvious as naturally to give rise to the idea of quickly performing by art what nature can only effect slowly, thus diminishing the period of suffering of the patient, by removing the source of protracted constitutional irritation inseparable from the process of reparation.

At an early period in the history of amputation, the incisions were made only through the mortified parts, leaving a dead portion still to be separated by nature. Galen, in cases of mortification in which a joint was implicated, recommended amputation through the articulation, in preference to the removal of the limb in the continuity of the bone; but he advised that a portion of the gangrene should always be left, to be separated by the efforts of nature, or destroyed by actual cautery, as circumstances might dictate. This method was adopted by the surgeons of his period with but very little variety in treatment, varying only as to the quantity of the dead parts which were to be left, and the kind of escharotic to be employed in assisting the ultimate separation.

This practice, in the infancy of operative surgery, although followed to a great extent, was not universally employed; for the Arabian surgeons deprecated the practice, and invariably left the gangrenous part to be separated by nature's efforts only. Until the fourteenth century, amputations were never performed through living tissues; and the only differences of practice, in cases of mortification, were in the means employed to facilitate the removal of the gangrene. At this period, the invention of gunpowder produced a new epoch in the surgical treatment of severe local injuries, and surgeons were obliged to have recourse to the amputation of shattered limbs through living parts; hence arose the invention of applying a ligature upon divided arteries. The spontaneous obliteration of the bloodvessels after gunshot wounds probably led the earlier surgeons to anticipate the permanent obliteration of an artery from the application of a ligature. Ambrose Paré seems to have been the first who recommended the amputation of living parts, placing confidence in the efficacy of a ligature to check the bleeding. This mode of procedure, as is too frequently the case on the first introduction of any new discovery, met with great opposition, and every obstacle which ignorance and envy could suggest was offered to its employment. Nothing, however, could check an improvement so scientific and practically useful, and the application of the ligature became universal. But even with this advantage, without the use of the tourniquet, amputation must still have been a very dangerous and tedious operation, as the vessels must have been cut through before the ligatures could be applied, and without any means being employed to stop the bleeding previous to their application: each vessel must therefore have required to be tied as soon as divided. There seems to have been but little improvement in the method of amputating between this period and the middle of the seventeenth century, when some rough attempts were made to command the hæmorrhage by a general compression around the limb, made before the amputation; but whether this was done with the view of benumbing the limb, or of checking the circulation of the blood, is not very clear. Morell, a French surgeon, seemed, however, to take a hint from this plan, and evidently employed an apparatus for the express purpose of stopping the flow of blood from the incisions through living parts; but his contrivance was so rough and complicated as to render it scarcely applicable to the purposes for which it was employed. Petit, at once, however, saw the advantages which might be derived from some modification of this instrument, and he may be said to be the inventor of the tourniquet. From this time every instrument essential to amputation may be said to be known; surgeons having now obtained the means of preventing bleeding during the operation by the use of the tourniquet, and after it, by the application of the ligature. These facilities were, however, at first productive of harm. The confidence gained by surgeons in consequence of possessing these powerful accessories, frequently led to the removal of limbs in cases where it was not warrantable; and many a patient became mutilated in consequence of the safety which the newly-invented mechanical contrivances afforded in the operation of amputation. The surgeons of that period, led away by the novelty, and too eager for the *éclat* of the operation, lost sight of the more important object of saving the limb by the application of such medical means as were likely to assist nature in the process of restoration; and much mischief arose from the abuse of a practice which, when judiciously employed, must be considered one of the greatest improvements in surgery. Soon, however, surgeons began to reflect upon the impropriety of the frequent mutilations to which patients were submitted; and an opposite party arose, which espoused the practice of attempting to save every limb. Le Dran, of France, and Bromfield, of our own country, published on this subject, and both condemned frequent recourse to amputation; but it may perhaps be considered, even at the present day, that, in their laudable attempts to check the needless sacrifice of limbs, they committed an equal error, too frequently leaving severe local injuries to the protracted efforts of nature; although it must be acknowledged that many cases of restoration, both of limb and health, are recorded, in which the opposite party would have amputated.

This controversy could not be fairly settled by these opposite parties during the heat of their contention, but yet much benefit was derived from their differences of opinion, as they showed that their respective plans were equally applicable, under particular circumstances; and that, in the one case, it was as right to attempt to save, as, in the other, to remove the affected limb. Hence arose a new epoch in the history of amputation; and the greater number of surgeons recommended a middle course to be pursued, pointing out, at the same time, the various circumstances which were to be taken into consideration, before either plan could be safely adopted; and various treatises, both in this country and in France, were written, for the purpose of laying down rules and principles by which the practice was to be regulated.

Amputation may be rendered necessary by a great variety of circumstances, arising from disease, or accidental mutilation; and whenever the power of medicine is insufficient to remove the disease upon which the local deterioration is dependent, or the constitution is incapable of keeping up the vital action in case of severe mechanical injury, the operation of amputating the part must always be resorted to, upon the principle that it is just to sacrifice a part for the preservation of the whole.

The formidable nature of the operation of amputation, the great pain and danger more or less inseparable from it, and the circumstance of its leaving the patient mutilated and crippled for the remainder of his life, render it a matter of great importance that the decision of the surgeon should be formed upon the strictest investigation; nevertheless, it is often very difficult to determine whether a limb ought to be at once amputated, from fear of the constitution giving way under the continued irritation during the protracted period necessary for the cure, or whether a certain amount of risk ought to be incurred in the hope of saving the limb, the surgeon trusting to medical treatment to support the constitutional powers under the severe calls made upon them in the progress of reparation. The character and extent of the disease or injury, the peculiarities of the structures implicated, the age, sex, and condition in life of the patient, the temperament, locality of his abode, the soundness or unsoundness of his internal organs, and his idiosyncrasy, must all be closely considered; and upon this investigation the practitioner must decide either upon the propriety of at once removing the limb, or upon leaving it to the restorative efforts of nature. Not that it is an easy task to form a correct judgment as to the power of the constitution to effect reparation, or the probability of the health failing during a lengthened period of disease and suffering: for so closely do the chances bear between the tendency of the disease to advance, and that of the constitution to repel its attacks, that conflicting medical opinions often serve to increase the difficulty, and that, too, at a moment when delay may permit of a change of symptoms which would entirely preclude the possibility of ever after resorting to the operation; and the danger occurring from such indecision applies equally to disease and accidental injury.

It does not necessarily follow, however severe the local injury or violent the disease, that immediate amputation can always be performed, for there may be concomitant circumstances that would render such practice inadmissible. For instance, in case of severe local injury, the nervous system may have received so severe a shock as to have produced that condition termed collapse, or in disease, the vital powers may have become much reduced. In the first instance it is necessary to wait for reaction, and in the second for the renovation of the health, before the patient can be subjected to the operation. It is, however, as I have said before, always difficult to determine the exact amount of injury which would render immediate amputation necessary; for an accident which in a robust constitution would perhaps be cured but with little functional disturbance, may in a person of weak powers and irritable temperament, produce so much general derangement that it would be most injudicious to attempt to save the limb at the risk of the life of the patient. It may perhaps be laid down as a general rule, that in cases of fracture attended with comminution of bone, laceration of soft parts, tearing through of bloodvessels and nerves, and the laying open of large joints, amputation should immediately be had recourse to, unless there be some concomitant circumstance to prevent it. Collapse is a frequent cause of delay in the performance of amputation after severe accidents, and the surgeon should never think of operating until after reaction has taken place. It is true collapse may continue through several hours, and indeed stimuli may be required to establish the reaction: the delay caused by this kind of prostration of the patient is not, however, so dangerous as it may at first appear to be, for during the period of collapse neither constitutional nor local irritation are induced, so that the quiescent state of the patient enables the surgeon to wait until the vital powers are somewhat restored, and the operation may then be performed with as much prospect of success as if, under different circumstances, the limb had been removed immediately after the accident. If, however, the injury be unattended with collapse, I believe the amputation should be performed as soon as possible after it has been determined on. Amputation may become necessary in case of distortion arising either from accident, disease, or congenital malformation; not only on account of the limb being unfitted for its natural functions, but from its proving an impediment to the performance of other duties essential to the common occupations of life. Under such circumstances I consider a surgeon bound to accede to the request of the sufferer, to remove an inconvenience of such a permanent character; unless, indeed, there be something in the state of the patient's health to forbid the performance of the operation. In some rare cases even slight local injuries lead to the necessity for amputation, on account of their inducing so high a degree of morbid sensibility in the nerves of the injured limb, as to leave no alternative but its removal. Secondary amputation is sometimes obliged to be had recourse to in consequence of the truncated extremities of the nerves of the stump becoming affected with a peculiar morbid enlargement, attended with such acute suffering as to lead to the necessity either of their extirpation or of a portion of the stump being removed. I have seen in the practice of others, and have myself adopted, both these methods, but I prefer the latter, not only because the removal of the diseased nerves is much more painful than the amputation of the stump, but also because the former operation is frequently unsuccessful in consequence of the diseased nerves again setting up the same morbid action after the sensitive bulbous extremity has been removed. I remember the case of a lieutenant in the navy, whose leg had been amputated, but who was never free from pain after the operation. Sir Astley Cooper cut down upon the sciatic nerve, and removed the sensitive tumour that had formed; but the operation was attended with great difficulty, owing to the excruciating pain it caused the patient, and after all it proved useless, for in a few weeks the pain returned as violently as ever, and it was necessary to amputate the stump close to the hip-joint: this operation proved, I believe, successful in removing the nervous pains. It is not always, however, that the secondary amputation is productive of any benefit. In my lecture upon neuralgia I have described another case of secondary amputation rendered necessary by neuralgic pain in the stump.

In cases of fracture even under apparently favourable conditions, the surgeon's efforts to save the injured limb are not always crowned with success. Unforeseen circumstances may arise, and notwithstanding the employment of the most judicious treatment, and the application of the best mechanical adjuncts, amputation may ultimately become unavoidable. The laceration of a bloodvessel may render a modification of treatment necessary, even if amputation be not actually demanded; for if the lesion of the vessel be in such a situation that the trunk can be tied without the fear of stopping the circulation of the blood through the limb, a ligature should be applied to the wounded artery; but if mortification be threatened, such a procedure would be unwarrantable, and amputation must in that case be had recourse to. The non-union of the bone after fracture, no matter whether the defect arise from constitutional or mechanical causes, greatly complicates the treatment of the injury; and it becomes very important for the surgeon to determine whether the failure in the ossific union depend upon a peculiar constitutional deterioration, or upon the physical condition of the fracture itself. If the constitution be at fault, the peculiar functional derangement must be sought for, and if discovered, combated by the use of appropriate remedies: if, for instance, the powers of the assimilative organs be impaired, they must be improved by the use of tonics and alteratives: at the same time great care must be taken to keep the fractured limb in a state of perfect rest. I am thoroughly convinced that motion of the ends of the broken bone is by far the most frequent cause of the non-union of fracture.

The ossific union is sometimes prevented by portions of muscle, fascia, or other structures getting between the rugged ends of the bone, and preventing their perfect coaptation: when there is reason to believe that such is the case, and all the usual means of adapting the fractured bone have failed, it becomes a matter of urgent question whether the substance entangled between the extremities of the fractured bone ought to be removed by cutting down to the injured part; whether the ends of the bone ought to be brought together by force, with the view of producing absorption of the intervening substance; or whether the limb, under such circumstances, ought to be amputated.

The first indication, viz., that of cutting down upon the fracture, should only be undertaken under very favourable circumstances: it must be remembered that by this plan a simple is converted into a compound fracture; and even if the removal of the intervening substance be effected, there may still be insuperable difficulty in perfecting the cure; the patient may, indeed, be reduced to a much worse condition than at first. I think it better to produce extension of the limb, and then to bring the broken ends of the bone in as close adaptation as possible, pressing them towards each other, so as to promote the absorption of the structure which is between the portions of bone; I believe that by such treatment I have ultimately succeeded in producing union where it had proved obstinate for some time under the employment of other means. Should a large nerve be entangled with other structures between the ends of the broken bone, it will be known at once by the pain produced in pressing the ends of the bone together: in that case, of course the pressure could not be maintained, and some other mode of treatment must be substituted; indeed, under these circumstances, amputation would probably be considered necessary.

I have seen instances of failure in the union of a fracture in patients in whom there could not be traced the slightest deviation from health to indicate the employment of one remedy in preference to another. In such cases I have sometimes succeeded in producing the consolidation of the bone under the influence of mercury, even after continued pressure, seton, and other violent means, had totally failed. Should mortification supervene upon severe injury to a limb, it ought to be ascertained, before amputation be performed, whether the death of the part depend upon constitutional inability to establish and maintain the process of reparation, or whether it depend upon a want of power in the limb itself, in consequence of the extensive destruction of the parts, an effect so often witnessed in gunshot wounds. Another question also arises here, as to whether the mortified part should be amputated, supposing no line of demarcation to be yet formed between the living and the dead tissues. In my opinion, if there be reason to believe that the loss of vitality does not depend upon an idiopathic defect, amputation ought at once to be performed; but if, on the contrary, it depend upon a defective constitution, the removal of the gangrenous part should be delayed until there is some evidence of an attempt on the part of the living portion of the limb to throw off the dead. There are different opinions on this point: some surgeons recommend that the operation should be performed as soon as mortification has commenced. I cannot agree with this practice, and believe that, under such circumstances, an incision should never be made in the living structure until the process of separation has commenced, although it may be right to remove a portion of a gangrenous extremity to diminish the inconvenience and debilitating effects arising from such a condition.

Tetanus may operate as a cause of secondary amputation, even after there had been just reason to hope that the limb might be saved. Traumatic tetanus has been regarded by surgeons as one of the most formidable of the diseases to which the human frame is liable, and it has occupied a degree of attention on the part of surgeons commensurate with its important character. The accumulated facts have, however, as yet, served to throw but little light on the true nature of this disease, and no remedy or system of treatment has yet been found sufficient to control its direful effects. In my lecture upon this subject, I have given a full account of the disease, its symptoms, and the effects of different kinds of treatment.

When tetanus has followed upon injury to the extremities, it has been a question whether immediate amputation of the limb ought not to be had recourse to, in the hope that, after the removal of the supposed cause, the effect would directly subside. I use the expression "supposed cause;" for, in my opinion, in all cases of traumatic tetanus the injury can only be regarded as the exciting cause, as there is always, I believe, a kind of tetanic diathesis in individuals who are attacked by this disease.

Baron Larrey, during the war in Egypt, amputated in several cases after symptoms of tetanus had commenced, and this practice was attended with sufficient success to induce him to recommend it. Instead, however, of the general adoption of this plan, I should recommend that the condition of the wound should first be strictly examined, and also the state of the constitution of the patient; so that, where there appears the least tendency to tetanus, prophylactic measures may be taken to ward off the attack. When, for example, there seems reason to dread an attack of tetanus in consequence of a punctured wound, the latter may be converted into an incised one by laying it freely open to the same depth as the original puncture; and should it then be discovered that a branch of a nerve had been punctured or partially divided, it ought at once to be cut completely through, so as to remove the continued irritation that would arise from its being only wounded. Some cases of traumatic tetanus have been given in my lecture on Tetanus.

When, from the operation of any of the causes enumerated, whether their action be immediate or secondary, the removal of a limb is determined on by the surgeon, the operation ought to be performed as soon as he believes his patient to be capable of sustaining the shock; for if the proper moment be permitted to pass, time may be given for the accession of a train of symptoms which may prevent the operation, or at least remove every reasonable hope of success. Moreover, there can be no advantage in delay when the constitution is suffering from the effects of a severe local injury. Primary operation should always, therefore, be performed as soon as the necessity for operation is determined on, unless, as I have before said, some constitutional symptoms render delay imperative.

If the patient be much prostrated, stimuli must be administered, and the operation may be performed as soon as reaction is established. It may, and does indeed frequently happen, that the accident which renders amputation necessary, may have likewise produced lesion of some vital organ: under such circumstances amputation ought never to be had recourse to; and it is owing to the probability of such an occurrence that surgeons always wait for reaction to take place before they submit a patient to a surgical operation.

It is not, however, external violence only which leads to the necessity of the removal of limbs; diseases of bone, affections of joints, and malignant growths, are not unfrequently the causes which lead to amputation; under any of these circumstances the same caution is necessary in the just appreciation of the patient's power to bear the operation, as when constitutional deterioration has arisen from mere local lesions; and the same considerations determine the question whether the diseased limb ought to be sacrificed, or whether the vital powers of the patient be sufficient to overcome the diseased action. In cases of malignant disease no such hope can be entertained, and the question then is, whether the malady has not propagated itself to some distant part, in which case it would be both cruel and useless to remove only a part of the malignant development.

When amputation is determined on, and the time fixed for its performance, I think it is a matter of but little importance as to the choice of the method by which it is to be performed. I shall, however, describe the different plans employed by modern surgeons.

The methods of amputating now practised are three: they are termed the *circular, oblique,* and *flap* operations; but before I describe the operations themselves, I shall devote a brief space to some preliminary (but too frequently neglected) considerations which I think deserve to be dwelt on.

The period of the day at which the operation should be performed I consider to be a matter of no little consequence. I always prefer the morning: firstly, because there is a benefit derived from the patient's better condition to support the shock soon after a night's rest; secondly, because the earlier the period in the day, the less time the patient has to brood over the dreaded ordeal; and thirdly, because there is sufficient time before the hour of rest for him to recover from the shock inseparable from the operation, and for the securing of arteries should any secondary hæmorrhage take place, an occurrence which is always much more frightful to the patient if it occur during the night; the difficulty in securing the vessels is also greater. The room in which the operation is to be performed should be fully prepared before the patient is summoned;

or if it be necessary that the operation should take place in the room already occupied by the patient, everything should be arranged so as to be brought in with the least delay and confusion at the moment required, the surgeon being a little before his appointed time, as he thus saves the patient an increase of anxiety as the time approaches. Shall I be thought frivolous, gentlemen, if I recommend you rather to steal into the house than to allow your servant to proclaim your arrival by a loud rapping at the door, which excites your patient's alarm, and may indeed render him unfit to undergo the operation. The surgeon should himself ascertain that everything he can want is at hand, and well adapted for his use: every instrument he requires should be examined, and having allotted to each assistant the peculiar duty he is to perform, the patient may be placed upon the table. If it be decided that the operation is to be performed while the patient is under the influence of chloroform, and if the disease be one which renders his removal from the bed to the table very painful, the chloroform should be administered before he is moved, as by this precaution more pain may often be saved than would be inflicted in the operation itself. The operator now determines in his mind on the mode by which he intends to perform the operation, choosing that which is the most appropriate to the case: the part of the limb to be removed, the peculiarities of the disease, the condition and relative position of the parts to be saved and those to be excised, must all tend to modify the direction of the incisions; ever bearing in mind, whatever plan may be adopted, that the great object must be, to leave a sufficient quantity of soft parts to completely cover the truncated bone, so as to form what is technically termed "a good stump," one in which the parts come into such easy adaptation, as to form a perfect covering to the bone, without the necessity for any force to retain them in their position. This effected, all the structures readily become firmly united by one dense cellular tissue, so as to form a cicatrix, the firmness of which constitutes a cushion competent to support the pressure to which it must be subsequently exposed.

LECTURE LXVII.

CONTINUATION OF AMPUTATION.

Arrangement and preparation of the patient—Application of the tourniquet—Position of the surgeon and assistants—Management of the knife; of the saw—Circular method of operating—Flap method—Precautions to be taken—Application of the ligatures—Secondary hæmorrhage—Irritative fever—Treatment—Erysipelas—Considerations respecting diet.

Amputation of a limb may require to be performed either through the continuity of any of its bones, or by the division of the structures constituting one or more of its joints. Of late years some surgeons have recommended amputation of the leg at the knee-joint, and the removal of the foot at the ankle; but I cannot believe, from the statistical account of such amputations, that it should be chosen, at least for any person who would afterwards be obliged to make use of the mutilated limb. Amputations at the shoulder and hip joints are not unfrequently required, the necessity arising either from the injury or the disease being so near to the articulations that the surgeon has no alternative but to disarticulate the limb. Malignant disease of a member may also lead to the necessity for this operation, as there is considerable danger of the disease quickly returning if any part of the bone be left which had been continuous with the disease. The phalanges of the toes and fingers, the metatarsal and tarsal bones, or corresponding bones of the hand, are generally removed at the joints; and the amputation of the hand from the fore-arm is more frequently performed at the wrist-joint, than by sawing through the radius and ulna.

When all the preliminary arrangements are complete, the tourniquet is to be applied, but it is better to defer it until just before the operation is to be performed; for if the compression be long maintained, the veins become distended, and a considerable loss of venous blood occurs in the first incisions. Some surgeons, indeed, avoid the use of the tourniquet entirely, and prefer the compression of the main artery by an assistant, urging that advantage is derived by this mode of treatment over the tourniquet, from the veins not being compressed, and that the muscles are better capable of freely contracting when cut through. In cases of very attenuated limbs, and when it is a matter of great importance to lose as little blood as possible, this mode of compression is admissible, and even advantageous, for the reasons given; but in large limbs I seldom amputate without the tourniquet, particularly in private practice; for if the patient be not steadily held, there is great danger of the artery escaping from the compression of the assistant—an inevitable loss of blood being the result: besides, if the pressure has long to be sustained, which is not unfrequent when there is any difficulty in securing the bleeding vessels, the assistant becomes so fatigued from the protracted exertion, that he cannot perfectly command the hæmorrhage, and a loss of blood is the consequence. When the tourniquet is applied, it should be placed as high up on the limb as possible, for the purpose of compressing the main trunk of the vessel above the distribution of its various branches, so that the circulation of the blood may be prevented as much as possible to the parts below. A further advantage is derived from the high position of the tourniquet—it is less capable of interfering with the contraction of the superficial muscles after their division—a point most essential to the formation of a good stump. There is some little skill required in the adjustment of the tourniquet to secure all its advantages. I should therefore advise every operator to apply the tourniquet himself, unless he is fully acquainted with the capability of his assistants; for if the artery be not effectually compressed, in the middle of his amputation he may find, to his confusion, that he is embarrassed by a fearful gush of blood as he divides the main artery of the limb, and some further pressure must be immediately employed to stay the hæmorrhage. In applying the tourniquet, its pad is placed immediately on the artery to be compressed, and so as to cross it a little obliquely, which ensures its retaining its position, when the screw of the tourniquet is tightened much more certainly than if the pad be placed quite parallel with the vessel: the straps of the tourniquet are then to be passed around the limb and back again, and tied in a single knot on one side of the screw, then on the other, and being carried back are to be tied tightly on the outside of the limb, exactly opposite to the point of the compression of the artery; the screw is then to be turned until the pulsation of the vessel is entirely stopped. A turn or two of a wetted bandage is sometimes placed around the limb, before the tourniquet is applied, to prevent the straps from injuring the integuments; but there is rarely any necessity for this precaution, and I think it somewhat interferes with the accurate adjustment of the instrument. As soon as the tourniquet is tightened, the limb is to be well supported by the assistants, and firmly held at the most convenient height for the operator. The position is sometimes obliged to be modified in consequence of some peculiar disease of the limb, or the kind of operation to be performed; this must be arranged by the operator himself, as he alone can place the limb appropriately for his own purpose. Indeed, the surgeon himself may not have made up his mind as to the steps he intends to follow, until he has had this opportunity of judging of the operation most applicable to the case; and I have myself been frequently induced to change the mode of amputating I had intended to employ, before I had had this best of all opportunities for a critical estimation of the most appropriate method.

Of late years the flap operations have been very generally employed in this metropolis; and I think I may say that the late Mr. Liston was a great promoter of this mode of operating. I very frequently adopt it; but I must confess that I am much disposed to go back to the circular method, from a clear conviction that better stumps are produced by it, and that the vessels are more readily and more securely tied, being much less likely to be wounded above the face of the stump than when the limb is transfixed for the purpose of making the flaps. It is certainly true that the flap operation is more quickly performed; but as chloroform is now so much employed, the additional time is a matter of little importance. I had thought until very lately that the flap operation had been almost invariably adopted in Paris: I was told, however, by M. Velpeau, that, on the contrary, it is less frequently had recourse to than in London; and unless some peculiar circumstances required it, he always preferred the circular operation.

In the amputation of a limb, I always stand so that the patient's body is to my left hand: I therefore place myself on the outer side of the right, and on the inner side of the left, extremity; it is advanced by some surgeons, that by this mode of proceeding you lose the advantage of grasping with your left hand the part to be removed while sawing. But I consider this more than compensated for by the greater facility with which the incisions can be made.

When the circular method of operating is selected, the following plan of procedure is to be adopted:—The limb is to be steadily held in a horizontal position, and at a convenient height for the surgeon, by two assistants, one of whom is to grasp the limb above the part where the amputation is to take place, forcibly drawing the integuments upwards, while the other assistant is to firmly hold the distal extremity of the limb. The surgeon then, placing himself with his left side towards the patient, and having decided on the point at which he intends to saw through the bone, commences his incision through the skin, three or four inches below that point, placing the heel of his knife on the centre of the upper surface of the limb. This he can only effect by stooping in a half-kneeling position, and passing his right arm under the extended limb, he draws the knife, with a moderate degree of pressure, round the limb, towards himself, rising at the same time to the erect posture; and allowing the handle of the knife to turn between his fore-finger and thumb, he completes the circular incision by bringing the heel of the knife to the spot where he first commenced the incision; with a little practice he will be enabled to complete this with one sweep of his knife. This incision should cut through the skin, cellular membrane, and fascia, to the same depth through its whole course. These tissues are then to be reflected (as the cuff of a coat is turned back) to an extent depending upon the size of the limb; to effect this, some few touches with the point of the knife will be required to detach the fascia from the subjacent muscles. A second circular incision is then to be made in the same manner as the first through all the muscles quite down to the bone, the incision commencing close to the reflected integument; in consequence of the more forcible retraction of the superficial muscles, the deeper ones, which are attached to the bone, will require another circular incision or incisions completely to denude the bone up to the point where the surgeon intends to saw it through; and in stout muscular patients, it is often advisable to use a linen retractor to expose the bone at the proper point for its division. The saw is now to be used, its heel being placed upon the bone close to the cut edge of the deep-seated muscles; by a gentle backward and forward motion of the hand it will fix itself in the bone in sawing; the point of the saw is to be directed downwards, and by a vigorous and rapid sawing motion, but without much pressure, the bone is readily sawn through without splintering, unless the assistants who are holding the limb perform their duty awkwardly, and either by too much pressure at the distal end splinter the bone, or by raising it "lock" the saw. The surgeon may obviate the difficulty arising from the latter occurrence, by not attempting violently to release the instrument, but requesting the assistant to depress his hands slightly, when the saw will be immediately set free. Should there, however, be any irregularity in the sawn surface of the bone, the projecting portions should be removed by the "bone-nippers." The next part of the operation consists in securing the arteries, and the future well-being of the patient depends much upon the manner in which this important step is effected. The main truncated artery should be first secured; to effect which it should be seized with a pair of forceps and drawn out of its sheath, so as to expose a sufficient length of the vessel for the ligature to be applied some distance above its open mouth, to preclude the liability of its being displaced by the force of the heart's impulse. Should there be any difficulty in finding the vessel, in consequence of its great retraction, the tourniquet may be slightly loosened, so that the escape of blood may point out the precise position of the bleeding vessel, although it may still be necessary in some cases to slit up the sheath before the artery can be secured. The remaining arteries are to be secured in a similar manner; and when all seem to have been placed in safety, the tourniquet may be removed; this should be done as soon as possible, as its pressure frequently keeps up a venous bleeding; and should any arteries which had hitherto escaped notice, bleed after the tourniquet has been removed, a ligature must be placed around them.

The surface of the stump should then be washed with cold water; taking care, however, not to remove the small portions of coagula too assiduously, for it is to be remembered that they constitute the means of preventing hæmorrhage from many small vessels, which would bleed again directly these natural plugs were removed, and lead to the necessity for ligatures, which would otherwise not be required. The edges of the stump may now be brought together and maintained in adaptation by one broad strip of adhesive plaister, a second portion being put around the limb pretty firmly, to prevent the retraction of the soft parts from the extremity of the bone. The stump should not be permanently dressed for four or five hours after the operation, and then with all the tenderness possible. This second dressing of the stump is to be effected by removing the plaister which had been put on immediately after the operation, and separating the edges of the soft coverings to the bone, for the purpose of ascertaining if there be any vessels still bleeding; if so, they must be secured: the edges of the wound are to be again brought together, and maintained in coaptation by adhesive plaister, and one or two sutures—an assistant, at the time of the plaister being applied, pressing the soft parts forward over the extremity of the bone, so as to prevent the possibility of any pressure being produced by the bone upon the approximated edges of the integuments. A bandage being then bound pretty firmly around the limb from the proximal joint to the stump, while at the same time the assistant is drawing the soft parts forwards, will usually prevent any future retraction of the muscles, and consequent projection of the bone, the effect of which is to form what is termed a " conical stump." All our precautions will not always prevent this untoward occurrence; and the fault may be on the part of the operator, from not having left sufficient covering to the bone; but it more frequently results from the natural tendency of the muscles to retract, which can only be obviated by judicious dressing. On the fifth or sixth day the stump should be again dressed, and with the same precautions as before: the strips of plaister should be removed with the greatest gentleness, not all at once; but, commencing from one extremity of the wound, two or three strips may be removed, the edges of the wound gently sponged, and fresh pieces of plaister applied before the other strips are displaced; in this way a support is maintained to the wound during the whole period of the dressing; care must also be taken that in removing the plaister we do not interfere with, or draw upon, the ligatures, as any interruption to the natural process of sealing the arteries might induce secondary hæmorrhage. In the first dressing, the end of the ligatures should always be brought out of the wound in the most direct line from the vessel to which they are attached; for if they be all bundled together for the purpose of bringing them out of the stump at one angle of the wound, they not only act as a greater source of irritation, but traverse so much of the wound as materially to interfere with its healing. The stump, under favourable circumstances, heals as readily as other incised wounds, but there are many circumstances which may interfere with and retard its perfect union; some of these may arise from physical, others from constitutional causes: the object of the surgeon must therefore be, to remove these sources of interruption by the application of appropriate remedies, which constitute, indeed, a higher order of surgical knowledge than that displayed in the amputation itself. These considerations apply equally to the healing of every kind of stump, whatever may have been the mode of operation adopted. But I shall speak of the surgical after-treatment when I have finished the description of the flap operations.

The mode of performing the operation of amputation by flaps differs from that in the circular operation, inasmuch as the covering of the bone is formed by one or more flaps obtained from the surrounding soft parts; and this kind of operation may in certain cases be most judiciously adopted: for instance, when, either from accident or disease, the integuments and muscles have been so implicated as to preclude the possibility of leaving sufficient covering to the bone by the circular mode. Such circumstances would often lead to the necessity of removing the limb higher up, and even of sacrificing a joint, were not the flap operation had recourse to. By this mode the covering of the bone may be made either wholly from one side, from both, or from the anterior and posterior aspects of the limb, as occasion may require. It is not improbable that, from the employment of this mode under such conditions, some surgeons have contemplated the idea of always using it in preference to the circular operation; but it seems to have been first recommended by a Mr. Lowdham, a surgeon at Oxford, in about the year 1679: I believe, however, he only adopted it in the minor amputations, such as fingers and toes.

In performing the flap operation, the limb to be amputated must be prepared precisely in the same manner as for the circular operation. The surgeon stands also in much the same position, and on the same side of the patient, and maps out in his mind the best mode to be adopted to secure the formation of a good stump; or, in other words, to leave an ample covering to the bone by making either one or two flaps, as the nature of the case will best admit. These flaps, or the single flap, may be made either by transfixing the soft parts by a double-edged knife, and then by cutting from within outwards; or by cutting from without to within, by making two incisions, dividing the soft parts in the form of the letter V reversed. When these flap operations are performed in the continuity of a bone, they are generally made on both aspects of the limb, but if at a joint, one flap will suffice; for the disarticulation of the head of the distal bone will enable the surgeon to cut his way out behind the joint without transfixing the soft parts.

In amputating a limb by the double-flap operation, the flaps may be made from either side of the limb, or from its anterior and posterior aspects, according to the choice of the surgeon; it is generally directed that the larger flap should include the principal vessels of the limb: and in this case the operator, in transfixing the soft parts, directs his knife as close to the bone as possible, so that in cutting his way out, he denudes the periosteum completely from the deep-seated muscles for what he considers a sufficient distance for the size of the flap required; then, by turning the edge of his knife slantingly, he cuts his way out, little else than the division of a few fibres still attached to the bone, and the use of the saw, being required to complete the removal of the limb. In the amputation of the larger limbs, as the thigh, leg, or even the upper arm, I have of late modified this operation, as I consider that, in adopting the plan described, the flaps are rendered unnecessarily bulky and heavy, and that the vessels are very liable to be wounded higher up than where the bone is sawn through, which often leads to considerable difficulty in securing them; the nerves are also left very long, and are rendered, therefore, more liable to future interference. To obviate this liability, it is recommended to subsequently cut off these strips of nerves; but the necessity for such a step, I am of opinion, had better be avoided; for, to say the least of it, additional pain is caused.

In performing the double-flap operation, I have been lately in the habit of transfixing the limb superficially with a long knife, leaving a large mass of muscle still covering the bone; and then, having the flaps well drawn upwards, have completed the separation of the muscles by circular incisions, cutting through the vessels and nerves in the second use of the knife; by this mode I entirely avoid the inconveniences alluded to above. When I first adopted this plan I had once or twice rather a deficiency of skin, especially when operating on the thigh: this arose from the great weight of the posterior mass of muscle drawing the integuments tightly over the anterior aspect of the limb, so that the width of skin left was not sufficient to cover the whole of the stump. My friend, Mr. Skey, to whom I was speaking of this operation, told me at once of an effectual method of overcoming the difficulty I have mentioned, by merely having the under surface of the thigh supported, or rather pressed up towards the femur, by an assistant, before the knife was passed through; by which mode the lateral dimensions of the whole thigh are increased, and a proportionately greater quantity of skin included in the flaps. This mode of operating may be considered as including both flap and circular operations.

The treatment of the stump immediately after the amputation is precisely the same as I have already described, but I think it is somewhat more troublesome to manage, in consequence of the greater liability to bleeding, from the danger, as I have already mentioned, of some of the vessels having been punctured by the knife above where the ligatures have been applied. In the partial dressing of the stump immediately after the operation, if some very small vessels continue to bleed, torsion may be tried to check the hæmorrhage, and to avoid the application of too many ligatures; but if any of these should still bleed at the period of the permanent dressing, torsion must no longer be attempted, but a ligature at once applied, for there is nothing so distressing to the patient, or which causes so much interruption to the union of the stump, as the necessity for removing the dressings after they have once been applied; and many a case, I am certain, has terminated unsuccessfully wholly from this circumstance. The application of ice to a stump will frequently at once put a stop to the oozing of blood, which in some cases proves very obstinate. Such cases of bleeding as arise from want of due precaution in securing the vessels are not "secondary hæmorrhages," the common acceptation of which term implies bleeding resulting from some constitutional cause rendering the arteries incapable of being obliterated from the application of the ligature, so that when it ulcerates from the vessel hæmorrhage supervenes. The danger of such a result depends upon the period at which it occurs after the amputation; if it be only two or three days after, there is reason to believe that some vessel had escaped the surgeon's observation, and subsequently bled upon the accession of the action necessary to the union of the stump; in this case the wound must be re-opened, the clot of blood turned out, and the vessel secured; but if secondary hæmorrhage comes on the third week after the operation,—at the period, indeed, when the ligature separates from the main trunk of the limb —there is too much reason to fear that the artery, from some deficiency of vital power, is incapable of becoming obliterated by the adhesive process. In such a case I should try gentle compression on the main artery of the limb, apply a bladder of ice to the stump, and administer a dose of opium; and should these means not succeed in checking the bleeding, I should place a ligature on the artery at the upper part of the limb, and not attempt to find the bleeding vessel by laying open the stump, in which there is great probability of failure, and a certain additional source of constitutional disturbance to the patient. I have found by experience that secondary hæmorrhage after amputation is most dangerous at that period at which the ligature should naturally be separated from the principal artery, and that, if it occur subsequently to that period, pressure on the vessel above will usually be sufficient to restrain the bleeding without the necessity for the application of a ligature. I am inclined to believe that these later bleedings do not occur from the large vessels, but from some of the overcharged collateral branches. Bleeding is not the only circumstance which may occur to retard the healing of the stump after amputation; various constitutional derangements may interfere with this process. A few hours after the operation more or less irritative fever usually supervenes, indicated by a white tongue, hot dry skin, anxious countenance, restlessness, and thirst. This attack is not to be combated by severe antiphlogistic remedies, but by narcotics and sudorifics, I usually order the following medicines :—

℞ Hydrarg. Chloridi, gr. iss.
Pulv. Jacobi veri, gr. iij.
Pulv. Opii, gr. ss. M. ft. pil.

Should the bowels become constipated, the following mixture:—

℞ Magnes. Sulphat. ʒvj.
Liq. Ammon. Acetat. ℥j.
Liq. Antimon. Potass. Tart. ʒj.
Tr. Hyoscyami, ʒj.
Aquæ distillat. ℥vij. M.
Capt. cochl. larga, ij; quaqua 4ta hora, donec alvus responderit.

If sickness be a prominent symptom, effervescing saline draughts should be prescribed; and every precaution taken at the same time to place the stump in the easiest position to the patient; ice or poultices may likewise be applied as the indications dictate. The removal of a strip of plaister from a stump will frequently cause all febrile symptoms to disappear; the necessity for this relief will be indicated by pain, and a sensation of fulness of the stump, resulting from effusion of blood or serum. It does not, however, necessarily follow that a patient should be the subject of such a febrile attack; all may be going on most favourably for the first fortnight, and the stump appear to be nearly healed by adhesion, when suddenly, without any apparent cause, a discharge may be found, from the appearance of which, the surgeon will decide upon the treatment required. Perhaps there is no better test of the constitutional condition of the patient than the nature of these effusions, which may consist of either blood, pus, or a plastic effusion; under this condition there is ample opportunity for the surgeon to display his scientific knowledge; perhaps, of all the late improvements in the science of medicine, there is none more important than the study of the anatomy of the fluids, by means of the microscope. Whether alteratives, stimuli, or tonics, ought to be administered, may almost unerringly be determined by the appearance of the effusions from a wound, although I do not mean to imply that there are not many other symptoms by which the condition of the patient may be recognised.

Even at a later period than this, untoward circumstances may arise, and render the re-opening of a stump necessary, even after it seemed to have perfectly healed: such an occurrence often results from a portion of the bone exfoliating, an event which is not always to be attributed to any fault of the surgeon in sawing through the bone, as a diseased condition of the bone itself may have led to its ultimate death. A ligature which may have included a portion of muscle or tendon may also for a long time retard the cure; and such continued irritation sometimes leads to a diseased condition of the truncated extremities of the nerves, which become bulbous, morbidly sensitive, and often productive of severe neuralgia, and consequent contraction of the muscles of the amputated limb. Nothing in the form of medicine seems to avail in these cases; nor, indeed, does secondary amputation always succeed, as where there is a constitutional tendency to neuralgia, the disease often returns after secondary amputation has been performed. I have already related a case in which three amputations were unsuccessfully performed, but in which the fourth, at the shoulder-joint, proved effectual.

Erysipelas is also a frequent cause, not only of retarding the healing of a stump, but too often even of the death of the patient, so that no surgeon should perform an amputation in either public or private practice while there is any epidemic tendency to erysipelas, unless the urgency of the case forbids delay, and the risk of waiting would be greater than that from the erysipelas. As soon as the irritative fever resulting from amputation has passed away, I am quite sure generous diet is one of the best means of securing the rapid union of a stump; and at the same time, the surgeon should interfere as little as possible with nature's process of reparation, by over-meddling with the wound.

LECTURE LXVIII.

CONTINUATION OF AMPUTATION.

Amputations of the upper extremity—Amputation of the phalanges at their articulations—Amputation of the third from the second phalanx—Mode of making the incisions—Double or single flap operation—Amputation of the phalanx at the metacarpal articulation — Removal of all the fingers at their articulations — Amputation of the thumb—Amputation of little finger—Disarticulation of the fingers from the carpus, leaving the thumb —Amputation of the hand at the wrist—Amputation of the forearm — Amputation at the elbow-joint; inexpediency of — Amputation in the continuity of the humerus; different methods —Amputation at the shoulder-joint; different methods—Accidental admission of air into a vein in performing this operation.

AMPUTATIONS OF THE UPPER EXTREMITY.

Severe injury to the hand often renders the amputation of the fingers necessary, with portions, or the whole, of the corresponding metacarpal bones. To perform these operations dexterously, the surgeon must be well acquainted with the anatomy of the hand, particularly with the exact relative position of the different parts; he will otherwise find considerable difficulty in accomplishing the amputation of a portion of the hand, or indeed of any other part he may be desirous of removing.

Amputation of the phalanges at their articulations. — These articulations are covered by the extensor tendons on their dorsal, by the flexor tendons on their palmar surface, and by the lateral ligaments on either side; all these, as well as the skin, must be cut through before the injured or diseased phalanx can be removed; which may be effected by the circular or flap mode of operating.

Removal of the third or extreme phalanx from the second.—The finger to be operated on being extended in the prone position, while all the others are flexed and separated from it, a circular incision is to be made a quarter of an inch beyond the articulation, through all the soft parts, directly down to the bone; a longitudinal cut is then made on either side, commencing from the first incision, and passing upwards to the joint: by this procedure a dorsal and a palmar flap may be dissected back; the joint is then to be cut through, and the amputation completed: it will be found that the flaps completely cover the anterior surface of the second phalanx, and are to be retained in their proper position by plaisters.

The third phalanx may be removed from the second in the following manner:—The extreme or third phalanx being semi-flexed, the surgeon introduces his knife immediately above the projecting head of the bone to be removed, and thus lays open the joint, when, by directing the edge of the knife along the palmar surface of the phalanx, he may cut his way out, so as to form a single flap from the palmar aspect of the finger. This is a much quicker operation than the former, and less painful; I therefore usually employ it. Care must be taken not to leave the flexor tendon too long in this operation; and should it not contract sufficiently, it may be cut off, as this gives no additional pain.

This operation is sometimes modified by first making a semi-lunar dorsal flap before the joint is opened, when a smaller palmar flap is required, and is then formed in the same manner as in the last operation.

In all these operations the flaps may be at once adjusted, as the arteries do not require ligature, pressure being sufficient to check the bleeding.

The amputation of the second or middle from the first phalanx should never be had recourse to; for as the proximal bone of the fingers has no flexor tendon inserted into it, after the removal of the other phalanges, it remains permanently extended, and becomes a source of extreme inconvenience: it is better, therefore, to remove the whole of the finger from the metacarpus than to leave this portion of it, which will assuredly lead to the necessity for a second operation.

I have many times performed these operations: generally speaking, they are easily accomplished; but still I have frequently been disappointed at the result, in consequence of the difficulty which sometimes occurs in healing the wound, and the tardiness with which the hand is restored to its functions. Local inflammation often arises after these operations, leading to the formation of abscesses, or exciting irritation in the fibrous tissues along the forearm, producing adhesion of the flexor tendons to their sheaths, so as sometimes permanently to interfere with the action of the muscles. The thickness of the cuticle on the palmar flap will also sometimes prevent the healing of the stump. Great caution, therefore, should be observed after these minor operations, and the patient be kept in as perfect a state of quietude as after those of a more important character.

Amputation of the first phalanx at its metacarpal articulation.—The finger to be amputated being firmly extended by the operator, while the rest of the fingers are flexed into the palm of the hand (which is to be held by an assistant), the surgeon places the heel of a long narrow scalpel on the dorsal surface of the head of the metacarpal bone, and drawing it in a semicircular direction from the heel to the point, along the side of the phalanx, forms the lateral flap, taking care not to complete it until the incision terminates on the palmar aspect, exactly opposite the point at which he commenced his operation: a similar lateral incision is to be made on the opposite side of the finger, and the two flaps being reflected, the structures of the joint are to be divided, and the finger detached.

Some surgeons recommend that the second flap should be made by cutting into the joint directly the first is completed, traversing the joint with the knife, and forming the second flap by cutting from within outwards: I have frequently performed both operations, but prefer the former.

An objection is sometimes made to the amputation at the metacarpo-phalangeal articulation, in consequence of the great width of the head of the metacarpal bone causing a large vacuity between the other fingers, especially when the ring or middle fingers have been removed; and from the strength of the hand being much diminished from the remaining fingers losing their support. It is proposed, therefore, that another mode of proceeding should be substituted for that of disarticulation, the only difference being, that the incisions are commenced posteriorly to the joint; the flaps may be formed in the manner just described. If preferred, this operation may be performed by transfixing the hand with the knife on either side of the metacarpal bone posteriorly to the joint, and then cutting a way out, terminating at the cleft between the fingers; the flaps thus formed are to be held aside, and the metacarpal bone being well exposed behind its articular head, it may be sawn through obliquely, with a metacarpal saw; the deformity arising from the projection of the head of the metacarpal bone is thus obviated, and the remaining fingers are also capable of being approximated. The removal of the head of the metacarpal bone is an operation I should never adopt for a labouring person, as the width of the palm of the hand is a matter of great importance in their occupations; but for those to whom the unsightliness is more important than the diminished use of the hand, it is a reasonable operation.

When this amputation is performed for the removal of the fore or little finger, the radial flap in the first instance, and the ulnar flap in the latter, should be made the larger, so as completely to cover the extremity of the metacarpal bone.

When it is necessary to remove all the fingers from their metacarpal articulations, leaving only the thumb, the following mode of operation should be adopted :—The affected hand being proned and held firmly by an assistant, who at the same time draws the skin of the metacarpal region forcibly upwards, the surgeon grasps the fingers in his left hand, and commences an incision on the cubital side (if operating on the right hand) of the metacarpo-phalangeal articulation of the little finger, just opposite to the fleshy sulcus which marks the centre of motion of that joint: this incision is to be carried firmly across the dorsum of the hand, half an inch anterior to the articulations, dividing the skin and extensor tendons in its course, until it reaches the radial side of the metacarpal joint of the forefinger: the flap should be convex towards the fingers, and should be turned back to expose the joints, which are then successively to be laid open, and the heads of the phalanges disarticulated from the metacarpal bones. The knife is to be passed under the heads of the phalanges, and by keeping it close to their palmar surfaces, a flap is easily formed, which is to extend as far as the line which marks the division between the fingers and the palm of the hand.

This operation may be varied by commencing the incision on the palmar surface of the hand, dividing, by a single semicircular cut, all the soft parts down to the heads of the metacarpal bones; the hand is then to be proned, and a second incision, commencing at the termination of the first, is to be made across the dorsal surface to the point whence the first incision was commenced, dividing at the same time the skin and extensor tendons: the heads of the phalanges are then to be luxated, and all the structures connecting them being divided, the operation is completed. The dorsal incision should be half an inch in front of the heads of the metacarpal bones, in order to secure a sufficient dorsal flap to cover those bones.

These operations are equally applicable when two or three of the fingers only are to be removed.

Amputation of the thumb from the carpus.—The right hand being supinated, (if the left, proned,) and the thumb abducted from the fingers, the surgeon commences his incision midway between the thumb and the index finger, directing the edge of his knife boldly backwards and outwards, until it comes in contact with the metacarpal bone of the thumb, along which he is to pass it (continuing to abduct the thumb as he cuts) until the edge is checked in its course by the os trapezium; the edge of the knife is then to be directed outwards, the joint opened, the head of the bone luxated, and a flap formed by separating the muscles from the outer aspect of the metacarpal bone, as far as its attachment with the phalanx. But as the outer flap thus made is usually very scanty, in consequence of the breadth of the head of the metacarpal bone of the thumb, I prefer the following operation:—

The hand of the patient being firmly held between pronation and supination, an incision is made commencing from the projecting tubercle of the os trapezium, which may be readily felt on the radial side of the palmar aspect of the carpus, just at the root of the thumb, and is always sufficiently conspicuous to mark its position; this incision is to be continued along the ulnar side of the thumb, as far as the metacarpo-phalangeal articulation; a second incision is to be made on the dorsal surface of the thumb, commencing just at the junction of the metacarpal bone of the index finger with the os trapezium, and being continued to join the termination of the first incision at the outer side of the metacarpo-phalangeal joint: this flap being reflected and held back, the thumb is to be abducted, and the inner flap formed by cutting downwards in the space between the index finger and the thumb in the manner described for the first incision in the last operation: the joint is thus completely exposed, and its ligaments being cut through, the thumb may be separated from the hand.

The amputation of the thumb, however, should never be had recourse to unless the disease or injury which it has sustained renders such a step imperative; for the function of the hand as a prehensile organ is so greatly diminished by the loss of the thumb, as to render it most important to save it if possible.

Amputation of the little finger from the carpus.—A very similar operation to that last described may be performed for the removal of this finger, but at the same time it is to be remembered that the plan adopted must be modified by the nature of the disease or accident which renders the operation necessary, as the directions in which the flaps are made must depend on the implication of the skin with the affection: this may indeed be said in in all amputations. The hand being supined, an incision is to be commenced in the cleft between the little and the ring finger, and continued down to the carpus. It will require some little force, and at the same time abduction of the little finger, to permit of the edge of the knife passing between the carpal extremities of the index and little fingers; but having reached the unciform bone, the point of the knife is to be directed above, and the edge being turned inwards, the joint is opened: the second flap may be formed by traversing the articulation, and bringing the knife forward in close apposition with the ulnar side of the metacarpal bone of the little finger, as far as its phalangeal extremity.

The operation may also be performed by making the inner flap first; but if this be adopted, the joint should not be laid open from within to without, as the knife would be likely to pass into the articulation of the cuneiform with the unciform bone, and would probably detach the former, or at any rate risk the laying open of the wrist-joint. I believe it is, however, a better plan in these amputations to saw off the carpal ends of the metacarpus, than to disarticulate them; it is certainly best for the fore, middle, and little fingers, as the extensor tendons of the wrist-joint, and flexor carpi radialis, are thus preserved; and even after amputation of the ring finger much support is given to the metacarpal bones of the middle and little fingers by the preservation of its carpal extremity.

In gunshot wounds, or other serious accidents produced by a crushing force, it may become necessary to amputate all the fingers at their carpo-metacarpal joints; should the thumb be also implicated in the injury, I believe amputation of the hand at the wrist-joint to be the better mode of proceeding.

Amputation of the four metacarpal bones at their articulation with the carpus, preserving the thumb.—To perform this operation the following are the steps to be taken: if it be the right hand, it should be firmly held in the position of supination, and an incision commenced about half an inch above the articulation of the metacarpal bone of the forefinger with the carpus, and carried boldly across the palm of the hand to the ulnar side of the little finger, cutting through all the structures which cover the metacarpal bones: this flap should be so formed as to present a slight convexity towards the fingers; it is to be reflected sufficiently to expose the carpo-metacarpal joints. A second incision, similar to the first, is to be made on the dorsal surface of the hand, and the flap also reflected to expose the joints; these being successively laid open, the hand may be removed, with the exception of the thumb. Should, however, the proximal extremities of the metacarpal bones prove sound, the articulation may be left entire, and the bones sawn through, by which means the extensor and flexor tendons of the wrist-joint may be preserved. Should the opportunity offer of saving a finger as well as the thumb, the surgeon should always avail himself of it, as the prehensile power of a finger and thumb may be adapted to most useful purposes, and is far superior to the assistance which can be derived from the most complicated apparatus. Extreme ingenuity may be often required to adapt the mode of operating to the peculiar exigencies of the case, and a thorough knowledge of the anatomy of the hand can alone enable a surgeon to prosecute his intentions; but with this knowledge a hand, which by a less skilful operator might be condemned to amputation, may be rendered a most useful organ, and probably permit the sufferer to follow, at least to some extent, his usual avocations.

Amputation of the hand at the wrist.—The hand being firmly held in the prone position, and the skin forcibly drawn up by an assistant, the surgeon commences his incision a little on the palmar side of the styloid process of the ulna of the right hand, and continues it through the skin in a semilunar form, terminating it on the palmar side of the styloid process of the radius, the convexity of this incision being towards the fingers, and crossing the centre of the digital row of the carpus: this cutaneous flap is to be reflected.

The hand being supinated, a similar incision is made on the palmar side, in doing which great care is required to prevent a button-hole opening being made in the skin, where the integument is so closely attached to the pisiform bone; the palmar flap being reflected, the extensor and flexor tendons are to be cut through close to the radius and ulna, and the knife carried through the joint, dividing all its remaining ligamentous attachments.

Some surgeons recommend a modification of this operation, laying open the joint immediately after the dorsal flap is formed, and then traversing the joint, form the anterior flap, by flexing the joint, and cutting out in the palm of the hand. I prefer the first operation, as by the second the tendons are left much longer, and less manageable, than in the other mode of proceeding.

The circular operation has also been adopted by some surgeons in the following manner: the hand being firmly held between pronation and supination, and the skin forcibly retracted, a circular incision is made through the skin an inch below the styloid processes of the radius and ulna, and being reflected, the operator presses down the patient's hand, and then traverses the joint from its radial to its ulnar aspect, dividing all the tendons and ligaments which connect the hand with the forearm.

The radial, ulnar, and interosseous arteries all require to be secured after these operations, and the edges of the wound are to be brought together by a single suture and plaisters. In amputating at the wrist-joint, care should be taken not to remove or injure the interarticular fibro-cartilage placed between the ulna and cuneiform bone, for as this cartilage attaches the radius to the ulna, the strength of those bones is much diminished by its removal, and the motions of the radius upon the ulnar may likewise be permanently destroyed : its removal may always be avoided by directing the edge of the knife towards the carpus, rather than towards the bones of the forearm.

I have three times amputated at the wrist-joint, according to the first mode here recommended. In one of these cases, after a gunshot wound, in consequence of the laceration of the skin the flaps were rather scanty; I therefore sawed off the styloid processes of the radius and ulna. In the other cases the stumps healed equally rapidly, and in neither of them did I remove the articular cartilages, a step in the operation which I consider perfectly unnecessary, as they do not appear to impede the union of the stump.

When either injury or disease has implicated the wrist-joint itself, as well as the structures of the hand, if amputation be required it must be performed through the forearm, and may be effected either by the flap or by the circular mode of operating. I acknowledge that I am myself a zealous advocate for the circular operation, both in amputations of the forearm and the leg, and have found in my own practice that the wound heals much more readily than when the flap operation has been had recourse to; this depends, I believe, upon the more symmetrical division of the muscles, and upon avoiding the exposure of lengthened strips of nerves, which are so frequently left in the flap operations, especially in the forearm.

The best point for the amputation of the forearm is about its centre, for below that the tendons are so numerous as to afford but a poor covering to the ends of the bones, and they are also but little competent to undergo adhesive reparation.

Circular amputation of the forearm.—The brachial artery being compressed by an assistant, or by means of a tourniquet, the arm is to be extended and held by two assistants in a position between pronation and supination, one of the assistants at the same time making extension from the wrist for the purpose of putting all the muscles equally upon the stretch, while the other draws back the integuments towards the elbow-joint. The surgeon is then to make a circular incision around the centre part of the forearm, through the skin and superficial fascia, and these are to be reflected upwards by dissection for at least an inch, so as to leave an ample covering to the ends of the bones; a second circular incision is then made through all the muscles to the bone, the incision commencing as near as possible to the everted skin. The edge of the knife should be directed slightly upwards, for the still further object of securing plenty of covering. A narrow amputating knife, or a catlin, is introduced between the bones, and all the interosseal tissues divided as high up as the first incisions will permit. The arm is then to be proned, and the saw applied first to the radius and subsequently to the ulna: during the application of the saw, the bones should be forcibly grasped together by the assistant, which much facilitates their division.

The radial, ulnar, and interosseous arteries must be secured, and they will all be found on the palmar aspect of the stump, anterior to the bones and interosseous ligament. The edges of the wound are to be brought together by slender strips of adhesive plaister, and the stump covered with lint dipped in cold water.

Amputation of the forearm with two flaps.— The arm is to be held in precisely the same position as that described in the last operation; the surgeon standing on the outside of the right arm, or the inside of the left, takes up between the fingers and thumb of the left hand the soft parts occupying the space between the radius and ulna in front; a few lines below the point where he intends to saw through the bone, he thrusts the point of his double-edged knife perpendicularly through the fleshy mass close to the bones, piercing the arm from the radial to the ulnar side; he then cuts downwards to a sufficient extent to form an ample length of flap, which he completes by cutting outwards through the skin.

In the second step the knife is again introduced in the upper angle of the wound, carried behind the radius and ulna, and thrust out at its lower angle: this may be easily effected by supining the arm a little as the knife is passing behind the radius; if this precaution be not taken, there is a probability of the knife passing between the bones of the arm, an accident which I have seen happen, to the great embarrassment of the operator. The interosseous tissues are to be divided and the bones sawn through, as before described. The arteries are next to be secured, which is always a more difficult task in the flap than in the circular operation, in consequence of the liability of the doubled-edged knife to wound the vessels above the point of their division. After the circular amputation of the forearm, I have several times been surprised at the rapidity with which the wound healed, and have certainly found the flap operations comparatively tardy in their union; so that, as I have before observed, I generally adopt the circular mode.

Amputation of the forearm at the elbow-joint.—I have never myself performed this operation, nor can I perceive any reason for its being chosen. M. Dupuytren, I believe, frequently adopted it; but I should have thought that the broad articular surfaces of the humerus, and its non-articular projections, would have offered considerable hindrance to the union of the stump, and afforded but a very inconvenient surface for the future adaptation of any mechanical apparatus. In performing this operation, M. Dupuytren proceeded in the following manner:—The forearm being supined and slightly flexed, the operator, standing on the inside of the arm, grasps between his thumb and fingers the fleshy mass situated in front of the condyles of the humerus, and raising it from the joint, passes a double-edged knife immediately across the bend of the elbow, and carries it downwards along the forearm for three or four inches, taking care not to entangle the edge of the knife with the coronoid process of the ulna. This flap being held back, he makes a half-circular incision on the posterior aspect of the arm, cutting through all the soft parts, thus connecting the angles of the base of the anterior flap: the capsular and lateral ligaments of the joint are next divided, and the insertion of the triceps muscle being detached from the olecranon process of the ulna, the forearm is removed. Some surgeons recommend sawing off the olecranon, and leaving it as a *point d'appui* for the triceps muscle, but it can afford so very slight a resistance to the contractions of that muscle that it seems to me useless to save it.

A modification of this operation has been proposed by some French surgeons, which precludes the necessity of amputating through the articulation, in sawing through the humerus immediately above the condyles instead. With this object the anterior flap is made by introducing the knife an inch and a half above the condyles, and then slightly flexing the forearm, the knife is carried down about two inches, and the integuments divided by cutting out. The upper angles of this wound are to be united by a posterior half-circular incision, which is to cut through all the soft parts directly down to the bone and above the olecranon process: the knife is to be carried around the bone completely to denude it, and the saw applied immediately above the condyles. The artery is then to be secured, and the edges of the wound adapted. A most excellent stump is formed by this method. I have never performed this operation on the living body, but frequently on the dead, and have no doubt of the facility of its execution; still, as I can see no advantage to be gained by the length of the humerus saved, and am impressed with the conviction that a higher degree of constitutional irritation follows amputation through large joints than that in the continuity of a bone, I have always preferred the amputation through the centre of the humerus, which appears to me to be a much more simple operation.

Amputation in the continuity of the humerus.—I have almost invariably adopted the following method in this amputation :—The patient being placed on a chair, and the subclavian artery compressed by one assistant, while the arm is extended by another, I stand on the outer side of the arm, and grasping the soft parts on the inner side, introduce the point of the knife a little below the junction of the middle with the lower third of the humerus, passing it perpendicularly from above downwards through the thickness of the arm, and continuing the incision downwards, and towards the surface, cut through the skin, and form the inner flap. I then introduce the knife at the upper extremity of my first incision, and pass it through on the outer side of the humerus, directing the handle of the knife outwards, as soon as its point has passed beyond the bone, so that I may bring it through at the same point where the first transfixing incision terminated. I complete the outer flap by cutting downwards and outwards. In making the inner flap I do not pass the knife close to the bone, but avoid cutting through the artery and trunks of the nerves; the two flaps are held back, and the deeper-seated muscles with the vessels and nerves are divided down to the bone by a circular incision; the bone is then sawn through, and the vessels secured. This operation combines both the flap and the circular modes of amputating, and avoids at the same time the painful process of dissecting back the skin, which is required in the common circular mode, and the formation of lengthened strips of nerves which is inevitable in the usual flap operation.

The circular operation is performed by separating the arm from the side (the artery being compressed either by an assistant above the clavicle, or by a tourniquet), and the skin being drawn upwards, the surgeon, standing on the outer side of the right, or inner side of the left arm, makes a circular incision, by one continuous sweep of the knife, through the skin and fascia of the arm. Some few strokes of the knife will be required to reflect the integuments sufficiently to give a good covering to the stump. The integuments being reflected, all the muscles are to be divided by one circular motion of the knife down to the bone, commencing the incision through the biceps close to the edge of the everted skin. If it be found that the superficial muscles have retracted beyond the deep-seated ones, and that they are still attached to the bone, they should be divided by a second incision made as high up as the point to which the superficial ones have retracted: the bone is thus perfectly exposed for the use of the saw, which should be applied as close to the muscles as possible. In a very fleshy limb a linen retractor will be found useful to protect the muscles from the saw.

Amputation of the humerus through its upper third.—This operation must always be performed by the flap method, and is prosecuted in a very similar manner to the amputation at the shoulder-joint; which operation, indeed, has been too frequently performed when not actually required, and when the method I am now about to describe might have been substituted for it.

The patient being seated in a chair, and the subclavian artery compressed above the clavicle, or the axillary artery, by means of a tourniquet the straps of which have been carried over the acromion, an assistant abducts the patient's arm, and the surgeon standing on its outer side, raises the deltoid from the humerus, and transfixes it about its centre in its long axis with a double-edged knife, which passes close to the bone, and being drawn downwards is made to cut its way out just at the insertion of the muscle. This flap being reflected, the knife is again to be introduced in a similar manner behind the humerus, and a flap made of the triceps; the bone is then to be cleared of all muscular fibres, and sawn off close to the base of the two flaps, which will be about an inch from its neck. The artery can be readily secured on the inner side of the posterior flap. This operation, when it can be performed, should always be chosen in preference to the amputation at the articulation, as the natural roundness and contour of the shoulder is preserved, and the danger and inconveniences concomitant with the disarticulation avoided.

Amputation at the shoulder-joint.—The amputation of the arm at the shoulder-joint may be easily accomplished in the following manner, which I believe was always adopted by Baron Larrey, and frequently by M. Dupuytren:—The arm being raised from the side, and the subclavian artery compressed, the surgeon, standing on the outer side of the arm to be amputated, raises the deltoid muscle and soft parts which cover the outer and fore part of the humerus, and thrusting a sharp-pointed double-edged knife through them close to the bone, immediately below the acromion, cuts downwards and outwards, and forms the outer flap. The joint is thus exposed; and is easily laid open by cutting through the capsular ligament and tendons of the supra-spinatus and teres-minor muscles; when by bringing the elbow inwards and backwards, the head of the humerus may be dislocated, and the knife being carried on its inner side, the internal or inferior flap may be formed, and the arm removed. The artery need not be divided in this operation until the last stroke of the knife for the completion of the internal flap, and the surgeon may compress it with the left hand before he divides it. This operation I consider the easiest of the many which have been proposed, but it is not the one which I have myself always followed, as I found in two instances in which I employed it that there was considerable difficulty in healing the wound. I have therefore, in my last two cases, adopted the following plan, which I believe was first recommended by M. Lisfranc:—

The patient being seated on a low chair, and the subclavian artery compressed upon the first rib above the clavicle, the surgeon should take his stand on the outer side of the arm to be amputated, (if it be the left arm, behind the patient:) the arm is to be slightly abducted, and rotated outwards, and a long narrow double-edged and pointed knife is to be introduced immediately below the projecting extremity of the acromion, and directed downwards and outwards along the outer and posterior surface of the humerus, until its point is brought out at the axilla just in front of the tendons of the latissimus-dorsi and teres-major muscles. The passage of the knife is much facilitated by the soft parts being grasped by the surgeon, and raised from the bone, the thumb and forefinger of his left hand marking the precise points where the knife is to enter, and make its exit. The outer flap is completed by the edge of the knife being turned downwards and outwards, and being made to cut its way out by a kind of sawing motion of the hand. The patient's arm is then immediately to be brought forward, and slightly rotated inwards, and the surgeon must reintroduce the point of the knife at the same spot in which he commenced the first incision, pressing it downwards towards the axilla, until its point projects just posteriorly to the fold of the pectoralis major, where it forms the anterior boundary to the axilla: with the same sawing motion of the knife, as before described, the anterior flap is completed. A middle strip, indeed the portion constituting the floor of the axilla, is thus left undivided, and in this portion is contained the axillary artery. The two flaps being reflected, the capsular ligament and tendon of the long head of the biceps are to be divided, and the joint laid open: the tendons of the spinatus and teres-minor muscles being then cut through, the head of the humerus may be easily dislocated, and the knife being passed behind it, and kept close to the neck of the bone, is to be brought sufficiently far downwards to make room for the surgeon to grasp with his left hand the undivided portion of the axilla, which includes the artery and axillary plexus of nerves; he then cuts boldly out, and the arm is separated, the surgeon still retaining the artery in his grasp until it is secured. I have twice performed this operation, and found no difficulty in its execution: but in one of the cases, the artery being secured, and Mr. Hilton, who was kindly assisting me, having removed the pressure from the vessels, air rushed into the vein, and my patient very nearly fell a sacrifice. This catastrophe in no wise resulted from the mode in which the amputation was effected, and is equally likely to occur in any other plan. I mention it merely to admonish the surgeon, that in every operation in which a large vein in the vicinity of the heart must unavoidably be wounded, he should take precautions to prevent the admission of air into the vessel. I have published this case in my lecture on the diseases of veins.

LECTURE LXIX.

CONTINUATION OF AMPUTATION.

Amputations of the foot—Preliminary considerations—Removal of the second, third, or fourth toes from their metatarsal bones—Steps of the operation—Amputation of the great toe at the metatarsal joint—Removal of the little toe from the metatarsus—Steps of the operation—Amputation through the metatarsal bones of the great toe—The operation; its varieties; their comparative advantages—Amputation of the great toe at the tarso-metatarsal joint—Modification of the operation—Case—Amputation of the metatarsal bone of the little toe at its articulation with the os cuboides — Amputation of the metatarsal bones from the tarsus — Precautions to be observed in forming the flaps, &c. — Amputation through the tarsal bones — Chopart's operation—Points to be observed to insure success—Amputation of the foot at the ankle-joint — Steps of the operation—Doubtful advantages of this operation — Arbitrary division of the foot.

AMPUTATIONS OF THE LOWER EXTREMITY.

Amputations of the foot.—The great object in all the operations on the foot is to remove no more than is actually necessary, as it is very important not to diminish the base of support so as to interfere with the ease and stability of locomotion. In the operations on the hand, an organ which is so constantly exposed to view, the surgeon's skill is exercised to produce as little deformity as possible; and this is even sometimes carried so far as somewhat to sacrifice a certain amount of utility, for the preservation of symmetry and goodly appearance, especially when the subject of the operation is of the gentler sex: and this sacrifice is perhaps admissible when we consider that one hand is capable of assisting in the functions of the other; while, on the contrary, in reference to the foot, one can in nowise compensate for the defect of its fellow.

When the second or extreme phalanges of the toes are either so severely fractured or seriously diseased as to require their immediate removal, it is usually recommended that the amputation should be performed at the metatarso-phalangeal articulation, from the idea that a remaining phalanx is more inconvenient, and offers a greater impediment to the future use of the foot, than if they were all removed; at the same time it is often advisable that the head of the metatarsal bone should be preserved, to maintain the natural breadth of the foot, for the purpose of support to the body, in which respect this operation differs from the corresponding one on the hand, in which the main intention is, to bring the fingers in close proximity to each other.

This rule should not perhaps be invariably adhered to with respect to the foot, more especially in those cases in which we find the extreme or even second phalanx permanently contorted and flexed under the foot. In these cases it is better I believe to amputate through the phalangeal joint, as the remaining phalanx still affords some support during progression and standing, and being never required, as the corresponding bone in the finger, to be submitted to flexion, its permanent extension offers no inconvenience.

Removal of either the second, third, or fourth toes from their corresponding metatarsal bones.—If amputated separately, the amputation is to be performed precisely in the same manner as in the removal of the fingers—viz., by making two lateral flaps, and then cutting through the structures of the joint. If, from a severer injury, it becomes necessary to remove the three middle toes, it may be accomplished in the following manner:—The foot being well supported, the surgeon sitting in front, the great and little toes are to be abducted from those to be removed, and the operator, grasping them in his left hand, makes a semicircular incision, commencing half an inch in front of the metatarsal bone of the second toe, and terminating at the same distance in front of the joint of the fourth toe (the incision will cross in the opposite direction if it be the right foot); this incision is to be made down to the bones, cutting through the extensor tendons; and the flap being dissected back, the joints are easily exposed: an incision is next to be made between the great and second toe, and between the fourth and fifth, carrying it back sufficiently far to terminate just behind the heads of the metatarsal bones, taking care that the incision is as extensive on the plantar as on the dorsal surface; the joints are now to be successively opened, and the heads of the phalanges dislocated dorsad, the edge of the knife is to be passed behind them, and the great and little toes being forcibly flexed, to place them out of danger, and the plantar flap being made, the three toes may be removed: the bloodvessels are next to be secured, and the edges of the flap being brought together by the twisted suture, the operation is completed. If the surgeon prefer it, the longitudinal incisions may be first made, and some advantage is gained by this mode of proceeding, so far as refers to the facility of placing the remaining toes out of harm's way; but an objection may be urged, that a great hæmorrhage results from these cuts, and therefore, the later they are effected in the course of the operation, the better.

Amputation of the great toe at the metatarsal joint.—This operation is very easily performed by the following method:—The foot being well supported, and the four outer toes abducted, an incision is to be commenced just behind the joint, and continued along the dorsum of the first phalanx, directing it obliquely outwards, and dividing the soft parts between the first and second toe; the incision is to be continued under the former, and carried round so as to terminate where it began, thus forming two flaps, which are to be dissected back; the ligaments of the joint are next to be divided, and the toe removed; the arteries are to be secured, and the flaps brought together so as to form a vertical commissure. Some surgeons perform this amputation by making two lateral flaps, as in the amputation of the fingers; but with respect to the great toe, I prefer the former plan.

Amputation of the little toe from the metatarsus.—The little toe may be amputated by the same methods that have been described for the removal of the great toe, or all the toes may be removed by the operation employed for the removal of the second, third, and fourth toes, merely by the extension of the transverse incisions, and the omission of the longitudinal ones.

As it is by some surgeons considered more advisable to amputate in the continuity of the metatarsal bones than at the articulations, and indeed, as it may be necessary to adopt this mode, in consequence of lesion or disease of the joints, I think it right to describe the method of prosecuting this operation.

Amputation through the metatarsal bone of the great toe.—This is effected in the following manner: the surgeon having first decided upon the point at which he intends to saw through the bone, and having seized the soft parts between the finger and thumb of his left hand, separates them as far as he can from the inner side of the bone, and plunges a straight sharp-pointed bistoury perpendicularly between the flesh and the bone, and just behind the point where he intends to saw through the bone; he then carries the edge of the knife close to the bone beyond the metatarso-phalangeal articulation, and cuts out, forming his inner flap. The soft parts covering the outer side of the bone are next to be drawn as much as possible outwards towards the second toe, and the knife again entered at the point where it was first introduced, and being forced out at the sole of the foot, without making any second wound through the skin upon either the dorsal or plantar surface, it is to be carried forwards between the first and second toes, and the outer flap formed: these flaps being held back, and the soft parts protected, the metatarsal bone is to be sawn through.

This operation may be modified by cutting from without to within, instead of transfixing, if it be preferred by the operator: the following plan must, in that case, be adopted.

The first incision is to be made in the inner side of the metatarsal bone to be removed (commencing immediately behind the point where the bone is intended to be sawn through): it is to be continued forwards and towards the plantar surface of the great toe, so as to cross the metatarsal joint, and terminate on its plantar surface just in the space between the great and second toes: a second incision is commenced at the same point as the first, and made to pass forwards along the dorsum of the toe, slightly inclining outwards, so as to terminate at the same point as the other incision: the flaps thus formed are then to be retracted, the toe separated from the surrounding parts, and the bone sawn through; the vessels are then to be secured, the soft parts brought together, and the operation is completed: either of these operations answers equally well for the amputation through the metatarsal bone of any of the toes, and the kind of injury which would lead to the necessity for such operation is usually severe—such as those inflicted in railway accidents, gunshot wounds, or from heavy weights falling upon the foot.

Amputation of the great toe at the tarso-metatarsal joint.—The first object is to discover the precise situation of the articulation between the internal cuneiform and metatarsal bone of the great toe. The situation of the joint being ascertained, the foot is to be firmly secured, resting rather on its outer edge, and an incision is to be commenced on the dorsum of the internal cuneiform bone, just behind its articulation with the metatarsal bone: this is to be continued forwards as far as the base of the first phalanx of the great toe: a second incision is then to be made, commencing from the under and inner edge of the internal cuneiform bone, terminating at the inner edge of the base of the first phalanx: the terminations of these incisions are to be united by a cross cut, and the whole flap dissected back to its base, which is attached to the internal cuneiform bone. The edge of the knife is then to be placed midway on the web between the great toe and second toe, and carried backwards close to the first metatarsal bone, as far as its articulation with the cuneiform bone, and then drawing the point of the knife upwards, so as to unite the termination of the second incision with the commencement of the first: the tendon of the extensor longus pollicis is next to be cut through, the tarso-metatarsal joint opened, the toe forcibly extended, and the two bones separated: the tendon of the peroneus longus is then to be cut through, and the metatarsal bone liberated from its further attachments. In making the second or outer metatarsal flap, the intermediate soft parts should be drawn outwards as much as possible, to secure the formation of a sufficient flap.

It has been recommended by some surgeons to commence the operation by first forming the outer flap, and having continued it as far back as the cuneiform bone, the metatarsal bone is to be drawn forcibly inwards to facilitate the admission of the knife into the joint, which it is made to traverse from without to within: the inner flap is then formed by carrying the knife round the articular surface of the metatarsal bone, and cutting away all the soft parts connected with the inner surface of that bone. The objection to this operation is, that but a scanty internal flap can be formed, in consequence of the great breadth of the tarsal extremity of the metatarsal bone of the great toe.

If it be desired to amputate through the continuity of the metatarsal bone, the same operation as I have first described may be performed, all the steps being similar, with the exception of the joint not being opened, but the commencement and termination of the incisions being determined by the points at which the surgeon intends to saw the bone through. One advantage is gained by the operation in the continuity of the bone, where circumstances will admit of it, that the insertion of the peroneus longus muscle may be left intact, and that a firmer base may be given to the inner side of the foot, which is essentially important to the act of progression. The following is a case of amputation at the tarso-metatarsal joint:—

Elizabeth Whitgrove, æt. 19, admitted into Guy's Hospital Feb. 27, 1849. Twelve years before, she had fallen down stairs, and injured her right foot; after that time the wound had opened, afresh about every three or four months; when she came into the hospital it was very painful, there was an abscess at the base of the great toe, also a small opening on the front and inner side of the foot. It was at once decided that the toe must be removed, but the operation was postponed in consequence of the health of the patient being a good deal affected by the local disorder. On the 17th of April the toe was removed. I was obliged to make the flap from the inner and under surface, as there were some sinuses on the upper part, and over the diseased bone. After dissecting back the flap, I opened the tarso-metatarsal articulation without difficulty; then, cutting outwards, removed the toe and metatarsal bone together.

Immediately after the operation there was some pain and irritability, but both were subdued by the remedies employed, and she afterwards continued gradually to improve until she was discharged quite cured.

Amputation of the metatarsal bone of the fifth toe from the os cuboides. — The usual plan adopted in this operation is to first form the inner flap by passing the knife between the fourth and fifth toes, and, abducting the little toe, carry the knife backwards until it comes in contact with the cuboid bone; the edge of the knife is then to be directed outwards and slightly backwards, to correspond with the direction of the joint which it is to traverse, the toe being more and more abducted as the structures of the joint are divided, the knife is then to be carried outwards sufficiently to clear the tubercle of the fifth metatarsal bone, and its edge being turned forwards, and kept close to the bone, a sufficient external flap may be preserved.

In consequence, however, of the great projection of the tubercle of the fifth metatarsal bone, I believe it to be a better mode of proceeding to form the outer flap first: by this means you more certainly secure a sufficient covering than when the soft parts are divided by drawing the knife forwards after the joint has been opened. In that case the operation will commence by making the outer flap, and this may be effected by commencing the incision upon the dorsum of the cuboid bone, immediately behind the joint which it forms with the fifth metatarsal bone, and continuing this incision along the whole length to the base of the first phalanx of the little toe: the knife is then to be carried around the outer side of that bone just in front of the joint, and then backwards to the plantar surface of the cuboid bone, the incision terminating immediately beneath where the dorsal incision commenced: this flap is to be completely dissected back, and the tarso-metatarsal joint laid open from without to within: the inner flap is then completed by drawing the knife forwards between the fourth and fifth metatarsal bones, after which the whole may be removed.

All the metatarsal bones may be removed from their tarsal articulations, but this operation can be but rarely required; and if any of the metatarsal bones can be saved, it should always be done, more especially that of the great toe, which is the chief source of support to the body, and performs a most important office in the act of progression. Injuries to the foot, however, sometimes render it necessary to perform such an amputation, and it may be effected in the following manner:—The foot being firmly held and supported on a low chair, the surgeon feels for the tuberosity of the metatarsal bone of the little toe, and from it draws an imaginary line at a right angle across the dorsum of the foot, which will terminate on the inner side half an inch behind the tarso-metatarsal joint of the great toe: he then firmly grasps the sole of the foot with his left hand, his thumb being on the tubercle of the fifth metatarsal bone, and his forefinger on the internal cuneiform bone, if operating on the right foot, and *vice versâ* if on the left; he is then to make a semicircular incision across the foot, the convexity of which is directed forwards and anterior to the tarso-metatarsal joints; this flap is to be dissected back, so as to expose the articulations; the knife is then to be passed into the dorsal aspect of the joint between the fifth metatarsal bone and the cuboid, and successively the fourth and third joints opened in the same way. The operator should then lay open the joint between the first metatarsal bone and the internal cuneiform, leaving the second metatarsal joint to the last, as it extends so much further back into the tarsus than any of the others: it is, however, easily disarticulated by cutting backwards on either side of the second metatarsal bone until the knife reaches the middle cuneiform bone: the dorsal aspect of this joint may now be laid open, and the metatarsus being forcibly bent downwards, the knife may be passed between the metatarsal bones and the sole of the foot, from which the plantar flap is to be formed. If there be any difficulty in passing the knife through the joints to make the under flap, it may usually be overcome by cutting through the tendon of the peroneus longus before attempting to make the flap.

In opening the second tarso-metatarsal joint by carrying the knife backwards, as I have described, on either side of the second metatarsal bone, care must be taken that the knife is not carried too far backwards into the articulations of the middle cuneiform bone with the other two, which joints are in so direct a line with the incisions that this is likely to occur: but it may always be obviated by not allowing the longitudinal incisions to extend farther back than the imaginary line first drawn straight across the dorsum of the foot from the tubercle of the fifth metatarsal bone to the inner side of the internal cuneiform in the continuity of which line the second tarso-metatarsal articulation is placed;—in fact, exactly in the same plane as the joint between the fifth metatarsal bone and the cuboid.

Some surgeons recommend that the plantar flap should be made immediately after the dorsal by transfixing the sole of the foot, and cutting out and then disarticulating the joints; there is, however, some difficulty in the execution of this plan, in consequence of the arched form of the plantar region.

The tourniquet had always better be employed in these operations.

If the injury to the foot requiring partial amputation be sufficiently anterior to the tarso-metatarsal joints, it is better to saw through the metatarsal bones than to divide them at the articulations, for the obvious reason that a broader base of support is left, and the use of the flexor and extensor muscles of the ankle-joint preserved; this should therefore always be the method employed when practicable.

Amputation of the foot through the tarsus.—M. Chopart was the first surgeon who performed this operation; I have myself employed it upon two or three occasions. Following the directions he has laid down, I found it easy of execution, but met with considerable subsequent difficulty in getting the stump to heal,—principally, I believe, in consequence of the hardness of the cuticle on the sole of the foot; still, however, it is an operation which, under certain injuries and diseases of the foot, must be had recourse to.

The most convenient mode of performing the operation is to place the patient upon a high chair, the operator sitting on a lower seat in front; then, grasping the sole of the foot with his left hand, he feels for the tubercle of the os naviculare on its inner side, and there places his forefinger or thumb, (according to the foot he is operating on;) immediately at the opposite point on the outer side he will feel the articulation between the os cuboides and the calcis. An incision of a semilunar form is then to be made across the dorsum of the foot, commencing at one of these points, and continuing it to the other, making sufficient pressure on the knife to secure the complete division of the soft parts. The flap being reflected, we may proceed to open the joints, which will be much facilitated by pressing the metatarsus downwards, and having separated the bones from each other, the knife may be passed on their under surface, between them and the sole of the foot, which is to be cut away from the bones by drawing the knife forwards as far as the anterior extremities of the metatarsal bones. This will be found to leave just sufficient flap to cover the face of the stump. In the last case in which I performed this operation, I made the under flap by transfixing the sole of the foot from one side to the other before I opened the joints, and I found this to be easier of execution than that I have just described, as proposed by M. Chopart. The plantar and anterior tibial arteries must be secured in this operation, and the flaps retained by the interrupted suture.

Amputation of the foot at the ankle-joint.—The tourniquet being applied, and the foot securely held by an assistant, with the heel resting on the edge of a table of convenient height, the operation is commenced by an incision being made beginning immediately below the centre of one malleolus, and passing in a semilunar direction across the dorsum of the foot to a corresponding point below the malleolus on the opposite side: the curve of this incision is towards the toes. A second incision is now made to unite the extremities of the first, by being carried across the sole of the foot from one malleolus to the other. The last incision divides all the soft parts down to the bones of the tarsus: the plantar flap is to be dissected back to the posterior extremity of the tuberosity of the os calcis, taking care at the same time not to wound the posterior tibial artery. The anterior or dorsal flap is also to be turned back, and the anterior aspect of the ankle-joint exposed, and being widely opened, by the foot being depressed as much as possible after the articulation is cut into, the anterior part of the tendo-Achillis is exposed, and it, as well as any other structures, still keeping the foot attached to the leg, must be carefully divided; the malleoli are then sawed off, and the amputation is completed. After the foot is removed, the plantar arteries are to be secured, and the flaps being brought together are maintained in apposition by means of the interrupted suture. The supposed advantage in this operation arises from the circumstance that in the formation of the face of the stump that structure is employed which is naturally intended to support the weight of the body, being furnished with a hard cuticle, capable of bearing pressure; and in addition to this point, the form of the stump must be looked upon as very favourable, as it is easy to adapt an artificial foot to it, so that but little deformity is produced. It is true that there is some difficulty in healing the stump, in consequence of the great thickness of the cuticle in this region, and this forms to a certain extent an objection to the operation.

In examining a healthy foot, there is but little difficulty in discovering the precise position of the various joints through which the amputations I have described are to be executed; and the anatomist can have no hesitation in performing them. But when, from protracted disease, the general conformation of the foot has undergone great change from swelling and effusion, all the natural indications of the position of each articulation are lost, and considerable difficulty necessarily arises in making the first incision through the soft parts to correspond with the precise point for laying open the joint intended to be disarticulated, and I have therefore arranged the following arbitrary division of the foot, to facilitate the steps in amputations of the tarsal and metatarsal bones.

1. A line drawn from the extremity of the great toe to the posterior extremity of the os calcis is divided nearly into equal parts by a point which marks the articulation of the internal cuneiform with the metatarsal bone of the great toe.
2. A line drawn from the tarso-metatarsal articulation to the extreme point of the great toe—that is to say, the anterior half of the line described above—is divided into equal parts by the point at which the first phalanx of the great toe is articulated with the metatarsal bone.
3. A line drawn from the tarso-metatarsal articulation to the centre of the inferior portion of the internal malleolus will be divided into equal parts by the tubercle of the os naviculare, immediately behind which is the junction of that bone with the astragalus.
4. A line drawn from the point just posterior to the tubercle of the navicular bone, and carried across the dorsum of the foot, will mark the division between the os naviculare and astragalus, and the os cuboides and os calcis.

LECTURE LXX.

CONTINUATION OF AMPUTATION.

Amputation of the leg—Different methods of performing this operation; the circular method—Preparation and position of the patient—Steps of the operation—Amputation of the leg by forming a posterior flap—Amputation immediately below the tuberosity of the tibia — Amputation of the thigh; different methods; circular method—Arrangement of the patient and position of operator—Steps of the operation—Treatment of the stump—Amputation of the thigh by the flap method—Plan of procedure —Precautions to be observed—Amputation at the hip-joint—Important character of the operation—Description of the operation—Modification of the operation—Cases.

AMPUTATIONS OF THE LOWER EXTREMITY—*continued.*

One of the chief considerations in the amputation of the leg relates to the choice of the part through which the section should be made; for although the limb may be removed in any part of its length, it is a great object to leave a stump of the most convenient length; and with this view perhaps the amputation through the upper third of the leg is the best, as it enables the patient to rest his knee on an artificial leg without having the deformity of a long projecting stump, which, at the same time, is always a source of great inconvenience. The amputation at the upper third of the leg should, in my opinion, invariably be chosen for those who will be afterwards obliged to make much use of the limb; but for persons in a higher class of life, especially females, where there may be anxiety to conceal the defect by an artificial limb, the longer the stump—or, in other words, the lower the amputation is performed —the better, as the facility in the adaptation of the mechanical apparatus will be so much the greater.

In this amputation, as in most others, differences of opinion exist as to the method by which the removal of the limb should be effected—whether preference should be given to the circular or to the flap operation: I prefer the circular, both in the amputations of the leg and forearm; but there may be circumstances arising from the nature of the injury or disease, which preclude the possibility of leaving a sufficient covering to the bones by the circular method; in such a case the flap operation may still be preferable. I shall describe the steps which are to be followed in the performance of both these operations.

Amputation of the leg at the upper third by the circular method.—For the compression of the femoral artery the tourniquet is usually employed, but it may be maintained by an able assistant. There are, as I have before said, advantages belonging peculiarly to each of these plans. The application of the tourniquet affords to the operator a sense of security which no substitute, not even the co-operation of a very experienced assistant, can afford; while, on the other hand, the compression of the main trunk by the thumb of the assistant interferes only with the circulation of the blood through the arteries, and thus diminishes, in great measure, the loss of venous blood which occurs when the tourniquet is employed.

In amputating, some operators make it a rule always to place themselves on the outer side of the limb to be removed, considering that the most convenient position; others always place themselves so that the left hand can grasp the portion of the limb to be removed. For myself, I prefer having my left hand always on the proximal side of the limb, that I may regulate the tension of the skin and soft parts while cutting through them; I place myself, therefore, on the outer side of the right, and inner side of the left limb.

In amputating the leg, the point at which the bones should be sawn through is about three inches and a half below the tubercle of the tibia; consequently the incisions through the soft parts must be made at least two inches below this, for the purpose of leaving sufficient covering to the bones; and this is effected by making a circular incision around the leg down to the very bones on the fore part of the limb, but merely through the fascia at the posterior part. The skin and fascia must next be dissected back, and everted to the extent of a couple of inches, which is, indeed, exactly the point where the bones are to be sawn through: the amputating knife then being placed as close as possible to the everted skin, all the soft parts down to the bones are to be cut through by one circular incision; and should one cut not suffice, the muscles are to be completely detached from the bones by repeated touches of the knife, so as to expose the bones a little above the level of the everted integuments. A catlin, or the amputating knife if it be narrow enough, is then to be inserted between the tibia and the fibula, and all the interosseal tissues divided, taking care that the knife does not pass above the level where the bones are to be sawn through, as in that case there is danger of the arteries and veins being wounded above the face of the stump, which adds much to the difficulty in the application of the ligatures. The bones are now to be sawn through, and during this part of the operation the assistant who holds the limb should rotate it inwards to a sufficient extent to bring the fibula to a level with the tibia; the two bones being then pressed together, by the firm grasp of the operator's left hand above, and by the assistant below, are easily sawn through, together, or the fibula may be sawn through first: in that case, however, great care should be taken that both are divided on precisely the same level, which may be secured by making at first a groove in the two bones by one and the same action of the saw. The anterior, posterior tibial, and fibular arteries, are to be secured, and frequently some muscular branches will also require ligatures.

When it can be adopted, I prefer the circular method of amputating the leg; but sometimes we may not have the choice either of the method or the part at which amputation can be performed, owing to the destruction of the soft parts, either by disease or accident, rendering the removal of the limb at a particular point, and by a particular mode of procedure, imperative.

Amputation of the leg by forming a posterior flap.—The operator, standing in precisely the same position as during the performance of the circular operation, and the limb being rotated inwards, places his thumb and forefinger on the opposite sides of the leg, an inch below the point where the bones are to be sawn through, and ascertains by the touch precisely the position of the posterior edges of the two bones: he then makes an incision down to the bones across the fore part of the leg from one finger to the other, and, without taking the knife from the limb, transfixes the calf of the leg, returning the point of the knife through the opening on the opposite side of the limb which was made by the commencement of the first incision: the posterior flap is then to be formed by cutting downwards along the course of the bones until he has separated sufficient to form the posterior flap, when he cuts obliquely outwards through the skin: the small anterior cutaneous flap is now to be dissected back, and a circular incision carried around the bones, to separate any remaining muscular fibres which may be attached to them: the catlin being then introduced between the bones, with the precautions described in the last operation, all the interosseous tissues are to be divided and the bones sawn through. The rapidity with which this method of amputating the leg is executed excites considerable *éclat,* but I do not think the stumps heal with the same readiness as after the circular operation; besides this, there is usually more difficulty in securing the arteries, and the nerves are liable to be left in long strips. I have already described, in my preliminary remarks on amputation, means which may be adopted in this flap operation to avoid these accidents—viz. the adoption of a course between the flap and circular mode of operation.

Two lateral flaps are sometimes recommended in the amputation of the leg, but I think this plan should never be had recourse to unless circumstances forced the operator to seek for covering to the bones from the lateral aspects of the limb.

Amputation of the leg immediately below the tuberosity of the tibia.—It may be possible that, in consequence either of accident or disease, the surgeon would have no alternative but to amputate the leg immediately below the tubercle; but in such cases, if there be not a sufficient quantity of sound soft parts to form a stump without the removal of the fibula by disarticulating it from the tibia, this operation, I unhesitatingly say, should never be had recourse to; the amputation should, in such cases, always be performed above the knee. I am well aware of the advantages derivable from the preservation of the knee-joint; but in the very attempt to do so, by the removal of the fibula for the purpose of lessening the quantity of bone surface to be covered by soft parts, there is so much danger either of opening the capsular ligament of the knee-joint, or of producing a subsequent inflammation in it from its close proximity to the tibio-fibular articulation, that I repudiate the method from its excessive danger even to life itself. I have twice performed this operation: once in a case of fracture, and once in necrosis. My first patient recovered, but the second died from abscess in the knee-joint, although at the time of the operation there was no indication of the synovial capsule of the knee-joint being injured.

As for the amputation at the knee-joint, I cannot conceive a single efficient reason for its performance: no benefit is derived from the additional length of the stump; the condyles of the femur afford but an ill-formed base for support; the large surface of articular cartilage must retard the healing of the wound; and the liability to subsequent ulceration in the cartilages of the patella and femur, as well as the greater severity of the operation, in consequence of laying open so large a joint, are all sufficient reasons for condemning this method of amputating. The only modification of this operation which I can consider admissible, is the sawing through the femur immediately above the condyles : but I have yet to learn the advantage gained by this additional length of stump, and I consider it a better operation to amputate at the junction of the lower with the middle third of the thigh.

Amputation of the thigh.—This amputation is most frequently performed at the lower third of the thigh, as at that point the stump is left of the most convenient length to the patient. Notwithstanding the size of the femoral artery and its branches, it is in this operation that the compression of the external iliac artery on the pubes by the hand of a skilful assistant, instead of the employment of the tourniquet, is more especially preferable, as the application of that instrument prevents the contraction of the skin and muscles for the formation of a sufficient covering of soft parts to the bone; on this account, pressure by the hand should always be had recourse to where it is possible; and, moreover, if it be of great importance that but little blood should be lost, the latter method is preferable, as much less bleeding will occur when the pressure is made by the hand than when the tourniquet is employed, as the latter method invariably leads to profuse venous bleeding.

The amputation of the thigh may be performed either by the circular or flap method : in a large full-sized thigh I consider the circular method preferable, as in the flap operation the weight of the flaps is so great that they have a tendency to drag forcibly upon the bone, so as to keep up a degree of irritation, and to interfere with the union of the stump. The choice between the two operations ought not to be a matter of mere caprice; I shall therefore describe the mode of proceeding in each.

Circular amputation at the lower third of the thigh.—The patient being placed on a table of convenient height, and brought close to its edge with his back well supported, the artery must be compressed either by the aid of an assistant or by the tourniquet, and the extremity about to be amputated must be firmly held by an assistant, one hand grasping the knee, and the other the leg, just below the calf. The operator should place himself on the outer side of the right limb, and on the inner side of the left; the sound leg should be held down out of the way of the surgeon, who, grasping the thigh with his left hand at the precise point at which he intends to saw the bone, and forcibly retracting the skin, passes his hand under the thigh of the patient, and places the heel of the amputating knife upon the anterior surface of the limb, two inches below the intended point of section of the bone; then by one sweep of the knife he must carry it round the thigh so as to terminate the incision with its point where he commenced with its heel. This incision should cut through the skin and fascia, which are to be dissected two inches back, at the same time being everted. The heel of the knife is again to be placed on the upper surface of the muscles, close to the everted integuments, and these muscles are all to be divided down to the bone; but however completely this incision may be made, some fibres of the deep-seated muscles will still require separation from the femur: this being effected, the muscles will contract even beyond the point to which the skin is everted. If the limb be very large, a linen retractor may be employed to draw back the muscles sufficiently to expose the point at which the bone is to be sawn through; but if the limb be but of moderate size, the hand of an assistant will be sufficient to guard the soft parts from the teeth of the saw.

The femoral artery and other bleeding vessels are to be secured in the usual manner, a bandage being applied around the thigh, and the stump only partially dressed, leaving the perfect adaptation of the parts until three or four hours after the amputation, after which all danger of further hæmorrhage may be considered as past, at least until the period when "secondary hæmorrhage" is liable to occur. By the term secondary hæmorrhage, as I explained in a former lecture, is meant the bleeding which sometimes results from constitutional causes, arising either from the inability of the vital powers of the patient to seal up the arteries by adhesive matter, or to resist the ulcerative separation of the ligatures from the vessels before the latter had become obliterated.

Amputation at the lower third of the thigh by the anterior and posterior flap method.—The patient is to be prepared and secured as in the last operation, and the surgeon, placing himself in the same position with relation to the patient, grasps the soft parts on the anterior part of the thigh with his left hand, and, raising them from the bone, transfixes the limb with a long double-edged knife, keeping close to the bone by depressing the handle of the knife as he crosses the femur; and then, by elevating the handle as he pushes it through the skin on the opposite side, he secures a sufficiently large anterior flap. The posterior flap is then made by inserting the knife at the point at which it was first introduced, and, carrying it behind the femur, it is brought out at the same counter-opening by depressing the handle of the knife, and then the posterior flap is completed by cutting downwards and towards the surface, as in making the anterior flap: the muscles are to be separated from the femur by a circular incision at the point at which it is to be sawn through, the flaps being held back; the saw is then to be applied to the bone, and the amputation is completed; the vessels being secured and the stump dressed as in the other operations.

When amputation of the thigh is required very high up, so high, indeed, as to approach the trochanter minor, the tourniquet should never be used, but the femoral artery compressed by an assistant upon the pubes, as the tourniquet prevents the necessary retraction of the muscles, and indeed, if used, must be placed so high up as to be nearly incompetent to its purpose. The flap operation is also in this case preferable to the circular, and I have in three instances employed this method, as already described in the amputation of the lower third of the thigh, forming an anterior and posterior flap; merely modifying the operation by making the flaps much less thick, and separating the greater portion of the muscles from the femur by the circular incision. In securing the vessels, care must be taken that the profunda, as well as the superficial femoral artery, is tied, as the vessels are cut through very close to the point at which the femoral artery usually divides into its superficial and deep branches; the stump should not be dressed immediately, as the patient is very likely to be faint from the severity of the operation, and the bleeding would probably not occur until reaction had taken place; this period is, indeed, the most proper at which permanently to adapt the surfaces of the wound. This operation is, in my opinion, very nearly equal, in danger to the patient, to the amputation at the hip-joint; it is usually had recourse to in consequence of severe fracture of the thigh, and I think I may safely say should never be employed in cases of malignant disease; for as it is admitted to be as dangerous to the patient as the amputation at the hip-joint, the latter operation should, I believe, always be preferred in such cases, as it diminishes the liability to the return of the disease.

Amputation of the lower extremity at the hip-joint.—It is true that this is an appalling operation; but so many successful cases are now recorded that there can no longer remain any doubt of the propriety of its being classed in the category of admissible operations. In patients attenuated from protracted disease, but still free from organic lesion of any vital organ, the result of this operation is not so much to be dreaded, although, when resorted to in consequence of severe external injury in a large healthy man, the prognosis must always be considered as unfavourable. I have in two cases made up my mind as to the propriety of performing this operation, but in both instances the patients faltered at the approach of the ordeal. I merely mention this to show that I had duly considered the steps I should adopt; I had, indeed, gone through on the dead body the various modifications of this operation employed by different surgeons. From the experience thus gained, I had determined upon following the directions laid down by Mr. Guthrie, but with some slight variation which appeared to me to facilitate the operation. Were I now about to perform this important amputation, the following is the plan I should certainly adopt:

The patient should be placed on a low table, with the nates brought close to its edge, so close, indeed, as to require careful support to prevent him from slipping off. An assistant is to compress the femoral artery upon the pubes. The surgeon places himself on the outside of the affected limb, and commences his incision a little below the centre of Poupart's ligament, and just to the iliac side of the femoral vein, continuing it downwards along the outer side of the thigh in a semilunar direction, and terminating it at the tuberosity of the ischium: this incision is to be carried quite down to the bone, forming a thick semilunar flap, which has its convexity downwards. The flap is to be dissected upwards from the femur as high as the summit of the trochanter major, when the assistant is to adduct the limb, and the operator must forcibly direct his knife inwards and slightly upwards until he brings it in contact with the head of the femur: by this process he cuts through all the outward rotators of the thigh, and lays open the capsular ligament of the joint: the femur is then to be turned inwards, so that the head of the bone is made to project, and the edge of the knife being passed between it and the acetabulum, the ligamentum teres, and the inner and undivided portion of the capsular ligament are cut through, and the internal flap completed by cutting downwards along the inner side of the thigh, so as to form a flap of the same extent as the external one, their size having been previously determined upon in relation to the bulk of the limb. The bloodvessels are then to be secured, the edges of the flaps to be temporarily brought together by a broad strip of adhesive plaister, but the stump should not be what is termed dressed for three or four hours after the operation has been performed; not, indeed, until the bleeding has entirely ceased.

Although many different modes of performing the amputation of the hip-joint have been proposed by English and Continental surgeons, the method I have just described appears to me preferable to any other, both with reference to the facility it affords to the operator, and the exactness with which the parts may be adapted after the removal of the thigh. Amputation may also be performed at the hip-joint by making an anterior and a posterior flap, following the same steps as in amputating (by that method) in the continuity of the thigh-bone. The patient being placed on the table, in the same position as that already described, and the artery compressed on the pubes, a long amputating knife is to be passed horizontally across the thigh, its point being made to enter (supposing it to be the right thigh) about an inch below the anterior and superior spinous process of the ileum, and being pushed close to the head of the femur, so as to include as much of the soft parts as possible, is to make its exit on the inner side of the thigh, so that it may pierce the gracilis muscle and skin, close to the ramus of the pubes; the anterior flap may be completed by cutting downwards to a greater or less extent, according to the size of the thigh. The limb is now to be forcibly abducted and depressed, so as to render the head of the bone prominent; the capsular ligament is now to be freely divided, and the joint being thus opened, the ligamentum teres is to be cut through with the remainder of the capsular ligament; the knife is then to be carried behind the head of the femur, and by cutting downwards and backwards, taking care to clear the trochanter major, the posterior flap is formed, and the limb removed. The arteries of the posterior flap should first be secured, as the principal bleeding results from the anastomosing branches of the internal iliac artery, and also because the femoral is already under the perfect command of the assistant. The treatment of the stump, as to dressing, is precisely the same as in the amputation last described. Some surgeons recommend a modification of this operation, making a very small anterior flap, and the posterior one sufficiently large to cover the whole of the space rendered vacant by the removal of the thigh. I do not myself perceive the advantage of this plan, which has, I believe, been adopted only on the supposition that after the femoral artery is tied, there is no longer a sufficient supply of blood to the anterior flap to maintain vitality of the stump.

The amputation at the hip-joint is an operation attended with so much danger, that it ought never to be undertaken without the most careful consideration, and never, I think, where the slightest alternative is left to the surgeon to amputate just below the trochanter minor.

In concluding my lectures upon amputation, I am desirous of making a few remarks upon some points of interest connected with the subject, particularly as to the time at which amputations ought to be performed, and the after effects of such operations. The period at which an amputation is performed is a much more important consideration than the method employed in the operation; in the former the judgment and acumen of the surgeon find ample field, whereas the latter is a matter of mere skill of hand, and forms a very inferior branch of our science. It cannot fail to have struck the minds even of those whose hospital practice is but limited, that the amount of mortality after primary amputations—that is, after amputations rendered necessary by severe injuries, far exceeds that after amputations consequent upon disease. This must at first sight appear somewhat remarkable when we remember that in the former case the subjects are generally strong and healthy, and in the prime of life, while in the latter they are reduced and weakened by disease. The statistics of amputation show, however, that the proportion of deaths from the consequences of what is called primary amputation is much greater than that after secondary operation; at the same time I do not believe that sufficient care is taken, in compiling tables of the comparative mortality, to define distinctly the difference between the primary and secondary operations; when, for instance, time is given after an accident for the constitution to become affected by the reaction required to produce reparation, I should consider that the moment is passed at which the amputation could be properly termed primary; by reaction I do not mean merely that re-establishment of the circulation which constitutes recovery from collapse; but the supervention of a febrile action consequent upon the injury.

When a violent mechanical injury is inflicted upon the human body, every part of its vital system sympathizes; the heart, the stomach, the liver—all are implicated: this sympathy is no doubt produced through the medium of the nervous system; it is that which receives the first shock, and which transmits the effect to the different organs of the body—such a shock to the system is sometimes the cause of immediate death; but it usually passes away, and the various organs are restored more or less completely to their natural state, but the impress of the morbid influence remains, the restorative power of the system at large being as it were in abeyance, if not to a certain extent destroyed. It is under these circumstances that primary amputations so often prove unsuccessful. When the constitution of the patient is sufficiently good to enable him to survive the first shock, the surgeon may await a favourable opportunity of amputating, and the chances of the recovery of the patient are very much increased. When we reflect upon this subject it will, I think, at once appear probable that the greater amount of mortality in primary amputations arises out of the peculiar condition of the system at the time of the operation;

what this condition is does not clearly appear; but at the same time we can easily conceive that when the whole of the vital powers are so violently depressed, the blood itself may undergo a change not easily overcome, and requiring time before it is restored to its normal state. Perhaps, after all, the most dangerous period in performing amputation after mechanical injury is that which is, as it were, intermediate to the primary and secondary effects of the mischief; this is the time in which irritative fever is kept up by the local injury: this state of the system is indicated by a quick pulse, loss of appetite, and the other signs of constitutional disorder. In injury to the lower extremities it is particularly dangerous to perform the operation at this period; the attention of the surgeon ought therefore to be wholly directed to the improvement of the constitutional symptoms, the only local treatment being such as would tend to lessen irritability. As the "intermediate amputation" appears to be thus dangerous, it is evidently better, in case of an accident which renders amputation necessary, to amputate at once, running the risk of the danger attendant upon primary amputation, or to wait until the intermediate period be passed, and then to perform the secondary operation. That the mere operation of amputation bears no kind of relation in its effects upon the system to that produced in accidents by machinery, by shot, crushing of limbs by waggons, &c., is well known, and probably these effects are in proportion to the shock produced upon the nervous centres. When amputation follows as the consequence of disease there is nothing but the effect of the operation itself to overcome; moreover, the surgeon has the opportunity of preparing his patient beforehand and of deferring his operation until he perceives that the most favourable moment has arrived. The fact is, that the mortality following upon operations appears to be altogether independent of the operation itself, and to depend upon the effect previously produced on the constitution. These considerations should always weigh with the surgeon in determining the question of amputation; for, as a broad principle, it may be taken, that amputations performed for disease, if executed with proper skill, and with precautions as to the preparation of the patient, are very seldom fatal; whereas in those which are requisite in consequence of severe injury, and which are performed while the system is under the depressing influence generated by the shock to the nervous system, the result is always to be looked for with some misgiving, experience having proved that in such instances the proportion of fatal cases far exceeds those in which disease has rendered amputation necessary.

LECTURE LXXII.

DISTORTIONS OF JOINTS.

Origin of the disorder; question whether local or constitutional; connexion with nervous system—Result of debility—Treatment—Orthopedy and tenotomy—Effects of distortion; considerations which ought to regulate the treatment—Use of apparatus; management of apparatus—Precautions required—Division of tendons—Description of the operation—After-treatment.

The normal form of the various structures of the human body can only be developed during the fœtal period, or maintained after birth, by means of a due exercise of all its functions; when these are in perfect operation, man appears under the characteristic form and size which experience has taught us to recognise as distinctive of his kind. If either before or after birth any interruption occurs to those natural actions by which the nutrition and growth of the body are effected, it often happens that deviations from natural form are the consequence, giving rise, if they occur during fœtal life, to monstrous and anomalous beings, and if at a later period, to malformed limbs, contractions of joints, &c. Many of these congenital malformations are completely beyond the reach of surgery, being produced, as they are, by an arrest of nutrition, and the consequent absence of portions of organs, or even of entire limbs.

With the physiological causes of such deformities it is not my intention to concern myself, in the present lecture: I shall confine my remarks to those deformities arising from contraction of joints, congenital or otherwise, which are amenable to surgical treatment.

Contractions of joints, and other abnormal conditions connected with the muscular system, are not confined to any particular region.

The head, the trunk, the pelvis, and the joints of the superior and inferior extremities, are all subject to the deformities arising from permanent muscular contraction; the same may be said of the muscles of the eyes, as in strabismus. The effect of these contractions upon limbs is such as must have early attracted the attention of surgeons, and it is probable, that even at a very remote period in the history of our science, attempts were made to remove the distortion consequent upon this condition. Such attempts were, however, doubtless very rude in their character, and consisted in all likelihood of a simple application of mechanical force by means of bandages or other apparatus. Hippocrates has described such distortions, and the means to be adopted for their cure; and some authors have contended, upon the authority of a passage which occurs in his works, that he was acquainted with the operation for the division of the tendo-Achillis in club-foot. However this may be, the treatment of distortions of the joints upon scientific principles is an invention which belongs to modern surgery; as the operation of tenotomy was probably first performed in the latter part of the past century, an authentic account being extant of an operation of this kind performed in 1784.

Before I come to speak of the means of curing contractions of the joints, there are some points which it is important to consider, inasmuch, as by them, the system of treatment to be adopted in a great measure depends. Firstly, then, as to the origin of these deformities? Is the disease entirely local, or does it take its commencement in disorder of some one of the centres of vital action? Some surgeons have believed that the cause of the deformity is in malformation or deficiency of the bones, existing congenitally, or supervening at a later period, owing to a defect in nutrition from some local or vital cause. Curvature of the spine has been supposed to arise in many instances from an abnormal form of the vertebræ, and club-foot from deficiency of the bones of the ankle, or malformation of those of the tarsus; it is impossible, however, to explain upon this principle the various complicated spinal curvatures which often take place in such contrary directions, and the immediate cause of which can only be referred to irregular contraction of the muscles of the spine. Although the direct cause of many of these deformities, both of the spine and extremities, arises without doubt from the permanent contraction of the muscles of the part, we must, I think, come to the conclusion that this muscular contraction is itself only a secondary effect, and that the origin of the complaint must be sought much deeper; we know that the relation of the nervous and muscular systems is of that intimate character, that one of the strongest indications of nervous lesion is spasmodic muscular action, such as marks, for instance, convulsions, epilepsy, and other nervous disorders of a similar kind. May we class tetanus among these nervous affections? If so, we have a further and yet stronger evidence of the effects of nervous irritation upon the muscles. These deformities are sometimes symmetrical, that is to say, club-foot occurs congenitally in both feet of the same individual; it is difficult to suppose that any merely local influence could exist at the same moment in both lower extremities, so as to produce equally the same effects upon them; is it not more rational to believe that one cause, central to the system, or at least generally diffused through it, produced the deformity in the feet through the medium of the nerves which were primarily affected? When the distortion is once established, it is clear that the position into which the bones are drawn by the contraction of the muscles may become a source of increased irritation and deformity; and the difficulty of cure may be rendered much greater by the readiness with which bones in an abnormal position adapt themselves to the circumstances under which they are placed; it is probably from the change which the bones had thus undergone in some cases in which the opportunity was obtained of dissecting the parts, that many surgeons have fallen into the belief that the primary defect lay in the bones.

As the lesions of the nervous system do not always commence idiopathically in the nerves themselves, the cause of the permanent muscular contractions which produce these deformities may perhaps, in many cases, be traced to disorders of the spinal cord, or even to the brain itself. Delpech, who originally advocated the doctrine that club-foot depended upon malformation of the bones of the tarsus, after a while abandoned it, and cites cases to show the influence of nervous disorders in producing contractions of the joints. He relates, among others, the case of a woman who was seized with contraction of the fingers and toes, after a disease of the spine in the lumbar region; another, of a soldier who was struck by a bullet in the thigh, the popliteal nerve being injured; complete varus followed this accident, although, of course, the patient had reached an age at which the bones are completely developed. Although in cases of club-foot or hand, torticollis, and other decided distortions in which there is powerful contraction of the muscles, the primary cause must, I think, be constitutional disorder; in spinal curvature, attended by diseased vertebræ, the cause is certainly local; while there is, again, another class of deformity, particularly of the spine, which must be referred to mere debility of the muscles—a debility more or less partial, however, and which has the effect of destroying the equilibrium or antagonism of the muscular force, the spine becoming consequently bent towards the side of the preponderating muscular power, like a bow. Now, it is evident that the treatment of these deformities, to be rational, must be regulated entirely by the considerations which relate to their cause, as the treatment which would be most beneficial in one class of cases would be likely to greatly increase the mischief in another; as an example of this, let us take curvature of the spine. If this deformity arise from mere muscular debility, causing want of antagonism and loss of equilibrium, the most effective and rational treatment would be judicious exercise of the muscles of the part—directed particularly to those which were in a weakened state; and the use of apparatus, or the interdiction of exercise, would in all probability tend to increase the disease by promoting the debility. If, on the other hand, the deformity be the consequence of, or accompanied by, diseased vertebræ, perfect rest would be the proper method of treatment, and exercise would operate most injuriously by increasing the irritation of the parts. These remarks serve to show that the first point of consideration for the surgeon is the cause of the disorder.

The treatment of difformities of the joints arranges itself under two heads—*orthopedy* or the restoration to the normal form by means of apparatus only, and *tenotomy* or the division of contracted muscles or their tendons. Before I enter upon the subject of treatment I must, however, say a few words respecting the effects of these difformities, and it is necessary that the surgeon should give proper consideration to these, particularly as some of the latter are rarely if ever cured. We can clearly understand that when viscera positively essential to life are enclosed within cavities bounded by unyielding parietes, the preservation of the normal form and capacity of such cavities must be of the highest importance to the proper fulfilment of the functions of the contained organs. A malformed pelvis in the female may interfere with the proper development of the fœtus in utero, and at the moment of parturition endanger the life of the mother as well as that of the child. How often has the physician occasion to refer chronic disease of the chest, or even its acute disorders, to distortion of the spine? Disease of the heart, and phthisis, may doubtless almost equally often be traced to this cause; and indeed the evil effects produced upon the system by such malformations are numberless. At the same time the effect of even spinal distortion upon the vital functions is extremely uncertain, and seems to be influenced by the constitution of the patient. This is evident, because in some instances the organs contained in the cavities affected by great distortion of the spine, continue healthily to perform their natural functions. Distortions may exist in other parts of the body as well as the spine, without any interference with the vital functions; under such circumstances the surgeon is of course only called upon to restore the normal form of the part,—an undertaking which it seems to me he ought to enter upon with circumspection, from the fear that any interference on his part, so far from producing a cure, or even improvement, may be a source of considerable mischief. Severe treatment of some of these difformities may be attended by danger, and the result may be the establishment of a condition in many respects worse than that which existed in the first instance.

Referring to what I have already said respecting the probability of distortions of the joints arising from a constitutional cause, it will be seen that the administration of internal remedies ought often to precede both the use of apparatus and the operation of dividing the tendons of the contracted muscles; for where can be the advantage of attempting to restore the parts by mechanical force to their proper form, while the abnormal vital influence which produced the deviation is still possibly in operation? The first rational indication is to examine into the state of the constitution; and if there be any traces of general disturbance, or of the lesion of any system, to which the muscular contractions can be referred, although the connexion between the supposed cause and its effect be never so remote, constitutional treatment should be employed. Applying mechanical apparatus to cure contraction of a joint, while the cause of that contraction is still remaining in force, is very like tying up the limbs of a patient in the hope of curing the jactitations of chorea. It may be, and indeed is in most cases, impossible to point out the existence of a constitutional cause of these permanent contractions, but this may likewise be said of tic douloureux and other disorders always referred to the nervous system; yet who can doubt that the most rational treatment of those nervous affections is constitutional, even although their manifestations be entirely local? There exists, however, one peculiar circumstance in distortion arising from contraction of the muscles: viz., muscular contraction in its normal development is a vital action depending upon some impression communicated through the medium of the nervous system, and ceasing as soon as that impression itself passes away; but when the contraction has become permanent, as in the case of club-foot, for example, the contractions have become so habitual to the muscles that even after the cause has ceased, the effect, that is, the contraction, remains permanent. There is still another point to be considered; the bones and ligaments accommodate themselves to the abnormal form of the joint, and are reduced to a condition from which nothing but mechanical force can relieve them, or rather, enable them to emancipate themselves. Thus we see that constitutional treatment must of itself be quite insufficient to the restoration of these difformities, however important and necessary it may be, as a preparatory step to the use of apparatus, or to the performance of a surgical operation to remove the contraction of the muscles. By the use of apparatus I must not be understood to confine myself merely to contrivances intended to draw the deformed limb into its natural shape, or to support parts apparently incapable of sustaining themselves against the natural efforts of the muscles. I mean to include also apparatus for the administration of appropriate gymnastic exercise,—a system of treatment which, under judicious medical superintendence, cannot be too highly considered, in relation to that kind of difformity, particularly of the spine, arising, as I have mentioned before, from loss of antagonistic power in the muscles of the different sides. In the application of orthopedy to the restoration of the normal form of a contracted joint, it must be remarked that the object is to effect a change in the relationship of the parts, by their continued forcible *traction* towards their natural position. It has, however, been considered by some surgeons advisable to apply the force suddenly and with sufficient violence to overcome at once the impediment to the restoration to natural position ; but there can be no doubt that in such cases it would generally be more rational to resort to the operation of tenotomy, as the history of orthopedy shows that such an employment of force, far from producing the curative effects expected from it, has often been the cause of deformities worse than that against which the treatment was directed, although it must be clear that the principles both of orthopedy and tenotomy are applicable to contractions of any of the joints of the body. I shall, in the remarks I have to make upon the treatment of distortion, take as an example club-foot.

I shall not describe minutely the kind of apparatus used for the purpose of straightening a joint; the surgical instrument makers have given us a great variety of these. Suffice it to say, that some precautions are necessary in its use, and that its duty is merely to continue a force already exerted on the part by the hands before the apparatus is fixed. It must not be expected that the part can be immediately restored to its natural position; the impediments to this can only be judiciously overcome by patience and continued tension. Close watching of the effects produced by the apparatus is requisite, or it may so interfere with the nutrition of the parts submitted to the pressure, as to cause sloughing, or, what is more common, excoriations and consequent violent inflammation. These accidents operate badly in two ways : in the first place they re-act upon the patient's health, and so retard the cure; and, in the second, they interrupt the progress of the treatment itself. It also sometimes happens, in the application of this apparatus, as in the use of compression for the cure of aneurism, that the pain is excessively great: this is felt chiefly in the sole of the foot, where the pressure necessary to bend the ankle-joint is applied. It has been shown by writers on this subject that the amount of deformity does not much affect the question of cure—that is to say, the difficulty of cure is not proportionate to the distortion, the most important consideration being the degree of change which may have taken place in the parts; for of course the greater the alteration in the shape of the bones and the adaptation of the ligaments, the greater will be the difficulty experienced in restoring them to their natural state. The employment of orthopedic treatment is not merely confined to those cases in which the division of the tendons is considered inapplicable; it may often be, and indeed is generally, in some form, employed as an adjunct to tenotomy, an apparatus being necessary to the restoration and maintenance of the part in its proper position during the cure.

I shall now describe to you the nature of the operation of tenotomy:—By Tenotomy I mean to speak of the division of muscles, tendons, or other fibrous tissues connected with muscles. This operation is perhaps most frequently performed upon the tendons of the foot for the cure of some form of club-foot. Although said to have originated in Holland in 1685, the first known operation of this kind was performed, as I have already said, at the end of the last century; after this, many surgeons, perceiving the value of the treatment, followed it, although with questionable success. It is to Strommeyer that we owe its present position among established surgical operations. The efforts of the other surgeons who had attempted the operation were isolated, but Strommeyer, in 1831, revived this treatment, published accounts of his success in several cases, and became ultimately the means of placing it upon a firm basis. There were many reasons why in earlier days of surgery the progress of an operation like tenotomy would be retarded; the supposed danger of wounding a tendon; the liability to inflammation of their sheaths when tendons were injured were much exaggerated sources of fear; it was also believed that when divided, the means of union fixed the tendon in its sheath and, preventing it from sliding, destroyed more or less the function of the part. Whatever may be the part of the body in which the contraction has occurred, the principles of the division of the muscles or their tendons to remove the tension, must be the same. In many cases the division of one tendon is sufficient, but in others in which the distortion is more complicated, the consecutive division of several of the tendons of the part may be required. Certain principles ought always to guide the surgeon in this operation; in the first place the integument and parts overlying the tendon to be divided ought to be as little injured as possible, the incision or rather puncture, by which the tendon is reached being as small as is compatible with the introduction and application of the knife to the tendon. After the division of the tendon, the part (the foot for instance) should not be brought forcibly into its natural position; the external incision should be first allowed to heal entirely, and then the extending apparatus applied, and the extension gradually but constantly maintained. The operation of the apparatus must be kept up until the foot is completely restored to its normal shape and position, or at least as nearly as may be, and even after this is effected, and the cure seems to be complete, the use of the apparatus must be continued for some time to prevent any return of the contraction. The extension, by means of the apparatus, must be carried on with great caution. Sometimes the difformity is easily overcome after the division of the tendon, at others the resistance continues to be very great, requiring, of course, more caution in the use of the apparatus. One point of importance I may mention here to which I alluded in speaking of orthopedy; this is, to be very careful respecting the pressure of the instrument, and to protect the parts from unequal tension by bandages and wadding, otherwise the great pain or the mechanical effects of the apparatus upon the structures will not improbably render all measures abortive. Before I go through the different steps of the operation of tenotomy there are a few points of consideration connected with the operation itself which demand attention. In performing the operation, or rather in forming beforehand his plan of operating, the surgeon should never forget the object of tenotomy—viz., the relief of distortion by dividing the tendon of the muscle or muscles which are in a state of tension. Now it will be perceived at once that this distortion of a limb may depend upon the contraction of more than one muscle, consequently it may be necessary to divide more than one tendon: of course the surgeon must be guided entirely by circumstances; but if we take a glance at the ordinary varieties of club-foot, my meaning will be rendered clearer. Firstly, then, in the distortion termed pes equinus, in which the heel is raised and the patient walks entirely upon the toes and the ball of the foot, it is the muscles of the calf of the leg which are contracted, and therefore the division of the tendo-Achillis alone may be expected to be sufficient to release the foot; but in the lateral distortions, varus and valgus, as they are called, according as the sole of the foot is turned outwards or inwards, the peronei, tibialis posticus, and flexor muscles of the toes may all be implicated as well as those of the calf; therefore the division of the tendo-Achillis will not alone be sufficient to permit of the foot being restored to its normal position. When therefore the division of one tendon does not liberate the contracted limb so that it may be restored to its natural form, and at the same time in the attempt to restore the part, other tendons become tense and salient, it will show that the contraction depended upon other muscles than that of the first divided tendon; and consequently the tendon which maintains the contraction ought likewise to be divided, and so on, even with others, if necessity requires their division to set the limb at liberty. This kind of procedure must nevertheless be conducted with due consideration, for although, after the division of the main tendon, the part be not capable of restoration to its proper position, it does not always follow that the surgeon should go on cutting tendons unadvisedly until the contracted limb can be rendered perfectly flexible; it must be remembered that all the tissues have acquired the habit of contraction independently of that diseased permanent contraction which constitutes the distortion. When therefore the tendon or tendons in which the defect primarily exists are divided, even if some contraction still remain, it should be left to the extending power of an orthopedic apparatus to overcome it; and there is a prospect of this treatment being successful if the ultimate contraction depend, as I have said above, upon habit and not upon disease.

There is another point which should be borne in mind in performing the operation of tenotomy on any part of the body; the intention of this operation, so far as refers to the operation itself, is to add to the length of the contracted muscle by maintaining it in such a position, after division, that nature will fill up with new matter the space formed between its incised ends, adding, indeed, to the original length of the tendon sufficient to enable it to permit of the natural movements of the part. Now the deposition of new matter to unite the divided tendon depends upon the reparative power of the part. When, for example, the tendon is surrounded by a sheath of areolar tissue, the reparation of the tendon is most easily effected; but in regions in which the tendon is only surrounded by a synovial membrane or a fibro-synovial sheath, the reparation is more difficult, and the operation less likely to succeed.

From this it will be seen that the tendo-Achillis, upon which, indeed, the operation is most frequently performed, is most favourably circumstanced; whereas in the tendons of the palm of the hand, which are surrounded by dense fibro-synovial sheaths, which are but slightly vascular, considerable difficulty in reparation exists, and consequently the operation is less likely to succeed. The operation of dividing a tendon is itself very simple and easy of execution; and as the description of the division of one is a description of all, I shall give that usually employed in the division of the tendo-Achillis :—In this operation the patient is seated in a chair, or upon the side of a bed, the contracted limb being supported by the hands of an assistant, a second assistant holding the foot; by pressing the toes and foot upwards he is able to bring the tendon into a state of tension. The operator should first trace with his fingers the course of the tendon, and having thus obtained an idea of its outline he passes the knife into the skin about an inch above the ankle, with its side towards the tendon, and presses it onwards until its point has passed the anterior surface of the tendon; he then turns the knife, bringing its cutting edge towards the part to be divided, and by a single effort the tendon may be cut through: this must not be done by sawing with the knife, but by pressing it against the tendon, bringing up the tendon at the same time to meet the edge of the knife, by flexing the ankle-joint. The moment the knife has passed quite through the tendon, a sudden snap is heard, and the resistance to the knife is entirely removed. The ends of the tendon can also be felt moveable, whereas before, the whole was in a state of tension. The division of other tendons, as I have before said, is precisely similar in principle to that of the tendo-Achillis. In the operation, a narrow knife should be employed, so that the external wound may be as small as possible; the immunity from inflammation depending probably upon the rapid adhesion of the sides of a small wound. I have several times divided the tendo-Achillis in cases of club-foot, but have generally deviated from the mode of operating, of which I have just given a description. The foot being held firmly by assistants, I direct the ankle-joint to be extended instead of flexed, so as to relax the tendo-Achillis, and then taking up between the finger and thumb of my left hand the skin behind the tendon, I make a small puncture with a lancet, and into the opening so made I pass a thin straight probe-pointed bistoury behind the tendon along its whole width; and then directing the cutting edge of the knife towards the tendon, and holding the knife firmly, I desire the assistants quickly to flex the ankle-joint, this action forces the tendon against the knife and cuts it through.

The advantage of this mode of operating is, that there is much less danger of wounding the posterior tibial artery, especially in children. After the operation, two or three strips of adhesive plaister and a bandage are the only dressing requisite; the limb must be allowed at the moment to remain in the position it took during its distortion; in this way the external wound ought to be allowed to heal, and then the apparatus to produce the natural extension of the foot must be applied. It would be useless to attempt to describe such an apparatus without the assistance of drawings, but it can be seen at every instrument-maker's shop: the principle is that of gradually forcing the foot from its contracted position up to, or indeed somewhat beyond, the normal angle with the leg. The precautions to be observed in the application of the apparatus during the progress of cure I have already mentioned. After the operation, two or three weeks generally pass before the foot can be brought to its natural position, and it is better in all cases to produce this effect gradually, even although it were possible to do so, as it is in some cases, immediately after the operation. When the use of the apparatus is abandoned, the cure being considered complete, it is still a wise precaution, particularly in children, to place a thin splint of whalebone or steel on each side, to support the part until the ankle-joint has acquired the habit of maintaining itself in its normal position. Exercise is necessary to give the tendon that firmness upon which the proper performance of its duty depends, and therefore some months are generally required for the patient to overcome the limping gait which had itself become a habit during the long-continued distortion.

LECTURE LXXII.

THE VENEREAL DISEASE.

Definition of—Division into two classes—Gonorrhœa—Nature of the disease—Not dependent upon specific taint—Purulent discharge sometimes concomitant with syphilis—Ricord's method of distinguishing between the virulent and non-virulent discharge—Predisposition to gonorrhœal inflammation—Symptoms of gonorrhœa—Seat of the inflammation—Balanitis and urethritis—Treatment—Phimosis—Symptoms—The operation for phimosis—Paraphimosis—Chronic gonorrhœa—Injections—Gonorrhœal ophthalmia—Gonorrhœal rheumatism—Stricture—Inflammation of the prostate gland—Inflammation of the testicles—Condylomatous and warty growths—Gleet—Gonorrhœa in women.

Diseases are termed venereal which are produced and communicated by sexual intercourse. These diseases differ, however, in their nature and character, and can scarcely be looked upon as arising from the same cause. Modern surgeons have consequently agreed upon their division into two classes, the virulent and the non-virulent. Practically it is of the greatest importance to distinguish between them, as the whole treatment depends upon the distinction.

It is said that the non-virulent form of venereal disease may be produced by intercourse with a person perfectly clean and in comparatively good health: indeed, the application of any irritating matter, or the existence of any condition that can produce irritation of a mucous membrane, no matter in what organ it may be situated, may give rise to an increase in the secretion of that membrane, and the secretion would at the same time lose its normal character. We see a good example of this action in purulent ophthalmia, in which the secretion of mucus becomes vitiated, and charged with a large quantity of pus.

When the above change of action occurs in the urethra, it is termed gonorrhœa: this is, however, an improper term, gonorrhœa signifying discharge of semen, whereas this disease consists of a discharge of pus from the lining membrane of the urethra in the male, or from the mucous coat of the vagina, the surface of the labia and other external female genital organs, and even sometimes from the mucous membrane of the uterus itself. Dr. Swediaur, an authority on venereal diseases, attempted to substitute what he considered to be a more expressive and correct term in the place of gonorrhœa—viz. blennorrhagia; but this is equally incorrect with the former, as it signifies a flow of mucus, and, as I have already said, the disease consists in the secretion of pus, not mucus. The most correct name hitherto applied to this affection is, I think, pyorrhœa, a discharge of pus. The term gonorrhœa is, however, still so generally employed, that I think it better to retain it in the present lecture, in order to avoid the confusion that may perhaps otherwise arise from the adoption of new terms as yet very limited in their use.

Gonorrhœa is, then, merely an inflammation of the mucous membrane of the urethra, and can produce no specific constitutional effect: it may perhaps occasion ophthalmia or orchitis; but the first can, under such circumstances, only be produced by contact of the matter from the urethra with the mucous membrane of the eye or eyelids; and the second is the result of extension of the inflammation along the vas deferens. If copaiba be given, an eruption on the skin may be produced by its action, or inflammation of the joints set up; but still there is nothing which can, in my opinion, be traced to virulent or specific action, and there is no danger of any specific eruptions arising.

It was formerly supposed that the matter discharged from the urethra in gonorrhœa issued from ulcers formed in the passage: such an idea probably arose from the opinion that pus was invariably formed only as a consequence of the ulcerative process. This question has, however, long since been set at rest, as it has been proved that a secretion of pus may take place without the formation of an ulcer, or even the abrasion of the surface of the tissue; and in post-mortem examinations of persons who have died while known to be infected with gonorrhœa, no appearance of ulceration could be discovered in the canal of the urethra, or in the neighbouring parts; but often, on the contrary, a thickening of the mucous membrane is found both in cases of chronic ophthalmia and chronic gonorrhœa.

Although there can be no doubt of the non-virulent character of true gonorrhœa, it is not always easy to say that a purulent discharge from the urethra is not occasioned by the action of a virus having produced a chancre within that canal; and in such a case, of course the disease would be capable of going on to secondary symptoms in the affected person, of producing a chancre in another individual. It is of great importance to form a correct diagnosis under these circumstances. Ricord recommends inoculation for the purpose of ascertaining whether the disease be virulent or not, and with this object he inoculates his patient on the thigh with some of the matter from the urethra: if it produce only slight irritation, and the puncture then heals up quickly, it may be confidently looked upon as not being the result of a virulent or specific action; but if, on the contrary, it produce a distinct pustule and subsequent specific sore, it would be sufficient proof that the disease is of a virulent character. The history alone of a case will never greatly assist the surgeon in his diagnosis, as patients are seldom able, even if they are willing, to throw much light upon the subject.

Some individuals seem more liable than others to attacks of gonorrhœa: this constitutional disposition is called a catarrhal diathesis; and in constitutions possessing this tendency strongly developed, all the symptoms of gonorrhœa may present themselves without any sexual intercourse having taken place. The lining membrane of the urethra is subject to inflammation from a variety of causes unconnected with venereal taint; and, therefore, purulent discharges sometimes commence from that canal without any apparent cause, and may always be produced by the injection of an irritant, such as bichloride of mercury, or dilute liq. ammoniæ, whilst the urethra is in a state of excitement, from erection, or any morbid cause. It is stated by Cullerier and Ratier that excessive venereal excitement may produce an attack of gonorrhœa even in individuals whose organs are in a perfectly healthy condition. This is an important consideration in medical jurisprudence; for it has often been asserted as proof of rape, that the subject has been infected with gonorrhœa, particularly in the case of violation of female children: as a purulent discharge may, however, be, and no doubt is often, produced by causes wholly independent of sexual intercourse, we perceive how much caution is necessary in giving a positive opinion in these cases. The gonorrhœal discharge sometimes appears to be produced sympathetically with affections of other parts of the body: thus it is said to have come on simultaneously with the cutting of a tooth, and this several times in the same individual; I have myself known a case wherein a severe gonorrhœa invariably accompanied an attack of gout, commencing and disappearing with it; in the last case it is probable that the gonorrhœa was the consequence of the irritating condition of the urine at the time. Mechanical irritation of the urethra will also produce an effect similar to that I have described: and it is well known that the introduction of a rough or ill-cleaned bougie may be followed by discharge from the urethra, having all the characters of that in gonorrhœa. All this would go to prove that true gonorrhœal discharge is not the result of the action of the virus of syphilis; and as another proof, I may mention that gonorrhœa can be communicated to the lower animals, whilst they are inaccessible to the influence of the virulent form of venereal disease.

The time at which gonorrhœa first makes its appearance after sexual intercourse differs very much in different subjects; it is said to vary from a few hours to eight or ten days, and in some instances even five or six weeks have elapsed between the time of connexion and the apparent commencement of the disease; it usually happens, however, that symptoms come on in from six to ten days, and in by far the greater number of cases the symptoms commence between the third and seventh days after intercourse.

One of the first signs of gonorrhœa is generally an itching sensation at the extremity of the urethra, the irritation often extending over the end of the penis; there is also a painful feeling when passing the water, and the lips of the urethra begin to swell, and become fuller than is natural; soon after these symptoms have set in, the discharge commences, a drop or two of purulent matter being noticed; the penis is altogether somewhat swelled, and the glans red, and looking as if half excoriated; it is very sore to the touch, and is often covered by a secretion: the canal of the urethra seems to be narrowed, consequently the stream of urine is smaller than natural: this narrowing of the urethra is probably produced by the swelling of the corpus spongiosum as well as of the lining membrane of the urethra. In gonorrhœa, blood is often mixed with the urine, and there is ardor urinæ attended with chordee, or at least a tendency to it: the latter is occasioned by the deposition of lymph in the corpus spongiosum, preventing that part from expanding to its normal extent, while the irritation of the urethra producing frequent erections, the penis is brought into a curved form: this condition is accompanied by excessive pain. The inflammation continues to extend from the fossa navicularis to the lacuna magna, and afterwards to the corpus spongiosum, and sometimes even to the perineum: when the inflammation has thus extended itself, the under part of the penis is very sore to the touch, and this soreness is felt as far as the anus, and gives great pain in the sitting posture. The inflammation may still go on increasing, reaching the membranous portion of the urethra, and causing spasmodic stricture; thence to the prostate gland, giving rise to great difficulty in making water, and often violent and painful priapism; lastly, it may extend to the bladder, increasing the suffering of the patient by giving additional pain, and a constant and pressing desire for micturition.

When the gonorrhœa has become established, the natural mucous fluid secreted from the surface of the urethra is changed to a whitish viscid matter, becoming gradually thicker, and assuming more and more the character of ordinary pus; if the inflammation be very severe this secreted matter becomes greenish in colour, from its admixture with blood, and shreds of lymph are sometimes expelled from the urethra with the urine. It has been well remarked by writers on this subject, that these changes depend upon the intensity of the inflammatory action, and not upon any specific poisonous properties in the fluid itself; and any other irritation, no matter what may be its source, equal to that existing in cases of gonorrhœa, will give rise to similar appearances and symptoms.

In gonorrhœa I believe the discharge seldom arises from a large extent of the surface of the urethra, the portion of the membrane which has become pyogenic not usually reaching more than about two inches from the orifice. When the inflammation acquires great intensity, a discharge of blood sometimes takes place from the urethra: this is generally merely sufficient to tinge the urine, but it may increase to a complete hæmorrhage. There are usually many symptoms present in a severe attack of gonorrhœa, which arise from sympathy of other parts with the urethra: for instance, pain and uneasiness are frequently experienced throughout the region of the bladder, the testicles often become extraordinarily sensitive, and sometimes require the use of a suspensory bandage; the glands of the groin are also occasionally sympathetically involved, and become enlarged, and suppurate. When the bladder is included in the extension of inflammation, the condition of the patient is much more distressing; owing to the irritation of that organ it cannot bear the ordinary amount of distention from the urine, consequently the patient cannot retain his water, and is obliged to pass it the moment the desire is felt: this is accompanied by violent pain both in the bladder and in the extremity of the penis. If an attempt be made to retain the water, the pain becomes almost unbearable; and even after the bladder is emptied there remains some pain, which lasts for a considerable time.

In a case which I have lately had under my care, I have witnessed a very unusual termination to gonorrhœa. A gentleman, aged 24, came to me with extravasation of urine, and fistulous opening in the perineum. Taking it for granted that this arose from stricture, I introduced a catheter, and found no difficulty in passing No. 8 into the bladder. I felt, indeed, not the least obstruction to the entrance of the catheter. Upon examining more closely into the circumstances of the case, I learned that the patient had had gonorrhœa for nearly ten months, although the symptoms were never very severe. About three months before he applied to me, and without any ostensible cause, a swelling formed in the perineum, attended with some slight constitutional disturbance. A surgeon who was consulted ordered poultices and fomentations, and a few days afterwards laid open the swelling, and evacuated a considerable quantity of pus; from that period the urine passed through the factitious opening. Soon after I saw him I made a deep incision into the perineum, filled up the cavity with lint, and kept an elastic-gum catheter in the bladder for about ten days; the wound in the perineum granulated, and for the last week he has ceased to pass urine otherwise than by the urethra. The gonorrhœal discharge still remains, however, uncured. Although extravasation of urine is the frequent result of stricture, ulceration of the urethra from mere gonorrhœa is very rare. The diagnosis of such cases is of great importance; it may be formed by a chemical examination of the evacuated matter; for although it may be thought that the presence of urine would be at once evident, still as the urine keeps oozing, and not passing either in a stream, or even guttatim, it is difficult to discover its presence without the employment of the following chemical test:—The best method of examination is to evaporate the discharge from the perineal abscess to the consistence of a syrup, then add a few drops of nitric acid; if urine be present, flattened crystals of the nitrate of urea will be easily detected; if they be not formed, it is a sufficient proof that the urethra is not ulcerated.

Gonorrhœa occurs under two different forms, and is divided by surgeons into Urethritis, or internal gonorrhœa, and Balanitis, or external gonorrhœa. The external, or, as it is sometimes called, the spurious gonorrhœa, affects the mucous membrane of the glans and prepuce, without extending into the urethra; it is often accompanied by aphthous sores, and the skin of the whole of the penis becomes inflamed; it often occasions phimosis, or paraphimosis, and sometimes goes on even to ulceration of the prepuce.

TREATMENT OF INTERNAL GONORRHŒA.

Whatever may be the cause of a gonorrhœa, it is impossible to distinguish between that produced by sexual intercourse and that having any other origin; and whatever may be the opinion entertained as to the identity of this affection with syphilis, one thing is certain, it is a disease of a highly inflammatory nature: this would seem to regulate, in great measure, the system of treatment to be adopted for its cure. The means of treatment are of two kinds, internal remedies and topical applications: in the acute stage, antiphlogistic measures must be adopted; and in the army, where we had a tolerable amount of practice in this way, we used to cure almost all our cases in ten or twelve days. The system we always adopted was to put the patient to bed, and give tartar emetic, so as to keep him in a constant state of nausea; the discharge, which was thick and pus-like, then became thin, and the chordee and priapism, which are so distressing to the patient, ceased almost immediately; in some cases leeches were applied to the perineum; occasionally blood was taken from the arm, and having subdued the inflammatory symptoms, we gave the balsam of copaiba as an internal remedy. In private practice we cannot, however, get patients to submit to quite such stringent measures; but at the same time I think you should always be active in your antiphlogistic treatment. After giving purgatives and nauseating doses of tartarized antimony to subdue the inflammation, I have found the following mixture very efficacious:

℞ Balsam Copaiba, ℥ss.
Pulv. Cubebæ, ℥ss.
Liq. Potass. ʒjss.
Mucilag. Gum. Acaciæ, ℥ss.
Aquæ destillatæ, ℥vijss. M.
℥j. bis in die sumenda.

This mixture should never be taken upon an empty stomach: about eleven and three o'clock are, I think, the best times; the mixture alone will remove all the violent symptoms, and stop the discharge, but unless previous lowering treatment has been adopted, the discharge will return; if, however, purgatives and tartar emetic have been given beforehand, the above mixture will generally effect the cure. In my own practice, if the symptoms be very urgent, I often order the mixture at once, which rarely fails to alleviate the distressing symptoms; I then employ antiphlogistic treatment, and afterwards recur to the mixture to complete the cure.

In external gonorrhœa, the patient is often unable to draw back the prepuce, owing to its becoming swelled and thickened; in that case, the discharge collects between it and the glans, and is somewhat difficult to reach: when in this condition, however, the prepuce need not generally be divided, as any topical application may be injected behind it: the black wash is the best preparation for this purpose, but Ricord has strongly recommended the use of a solution of nitrate of silver, six grains of the nitrate being dissolved in an ounce of water: under these circumstances, I also always employ at the same time the liquor plumbi diacetatis lotion to cover the whole of the penis, for the purpose of subduing the local inflammation. Ricord states that contact between the two inflamed mucous surfaces tends to keep up inflammation; he therefore proposes to carefully introduce a piece of linen between them; I have found this plan to be very effectual, but prefer a piece of muslin to the lint, as the latter frequently causes great irritation, from the chloride of lime with which it is bleached. When the skin becomes much inflamed, and the inflammation extends downwards to the root of the penis, the skin sometimes separates from the corpora cavernosa, and deep and extensive sloughing is the result.

Let me here again remark, that gonorrhœa is not a specific disease: mercury is therefore not required; antiphlogistic remedies must be had recourse to, and antimony is, I think, the best. For the purpose of depletion, I bleed if necessary from the arm, in preference to applying leeches locally; for if by chance the gonorrhœa be complicated with a chancre in the urethra, the leech-bites may every one become syphilitic ulcers. Now, as it is almost always a matter of uncertainty whether there be a chancre or not, when you have a patient with a prepuce incapable of being drawn back, it is safer to cup in the perineum, or bleed in the arm, than to apply leeches to the part; as in the latter case it is possible that a great number of chancres may be the result of the attempted curative measures. Ricord states, however, that neither the number, size, nor seat of the chancres makes any difference to the ultimate cure, unless they be phagedænic; but in this opinion I think he will find very few supporters. In the treatment of the external gonorrhœa, the position in which the penis is maintained is very important: it should be supported against the abdomen, so that the distribution of arterial blood may be checked, and the return of the venous blood facilitated; the inflammation should then be subdued by antiphlogistic treatment and perfect rest. With this object a lotion of the liquor plumbi diacetatis and spirit. vini should be applied; and if the prepuce be constricted, it ought to be injected with black wash, a piece of linen being laid between the prepuce and the glans, as I have mentioned before. Should the inflammation go on unsubdued, phimosis may be the result: if such should be the case, I strongly recommend, as a principle, to avoid dividing it, if possible, as the operation is likely to lead to considerable deformity, and by poppy-head fomentations, rest, and general antiphlogistic treatment, it may usually be removed without much difficulty. Sometimes, however, the operation is unavoidable, and it becomes necessary, not on account of any alteration in the skin itself, but owing to the swelling and thickening of the mucous membrane, which occupying so much more space than it naturally ought to do, prevents the skin from being drawn back over the glans. If it then be found that the discharge continues obstinately, and that there are sores beneath the prepuce, it must be divided, and if small warty excrescences be perceived, the prepuce ought to be freely laid open. In such a case Ricord would inoculate the patient with some of the matter, and if a chancre were the result, he would proceed at once to administer mercury, upon the conviction that the disease was specific in character.

The operation for phimosis is easy of execution, but, like all other operations, it may be well or ill done: if the skin be much drawn forwards before the director is introduced, it will be divided too extensively in proportion to the mucous membrane; the director should therefore be introduced before the skin is drawn forward, and should be passed backwards to the corona glandis, so that both skin and mucous membrane may be divided to an equal extent. This is the ordinary operation for phimosis, but experience has shown me that it is better to divide the prepuce on its under surface, by the side of the frænum, as the incision in that situation causes much less deformity and gives equal freedom to the constriction.

There is a species of phimosis which is not the result of disease, but which proceeds from congenital malformation of the parts: in such cases the prepuce should be circumcised. This operation is performed by drawing forwards the skin of the prepuce, and with one sweep of the knife excising its extreme portion; by this incision, the skin only will usually be cut through, leaving the mucous membrane uninjured: the latter may then be split open to the corona glandis, after having been slit at its preputial edge with a pair of scissors. In this form of phimosis it sometimes happens that the aperture left through the prepuce is so small that a knitting needle can scarcely be introduced into it: in consequence of this condition, there may exist great difficulty and pain in passing the water. There are a great number of small follicles about the corona glandis, and the secretion from these, if confined, rapidly undergoes decomposition. In phimosis this is likely to happen; indeed, from the difficulty in keeping the part clean, it is almost a certain consequence, and then serious diseases may be set up in the part. Sir

Astley Cooper says that he "never saw a case of cancer of the penis in which this condition of the prepuce had not congenitally been present," and therefore in all cases he recommended circumcision.

There is a condition exactly the reverse of that which I have described; it is termed paraphimosis; in this the prepuce is constricted behind the glans, and cannot be drawn forward. This disease is, I believe, strictly speaking, never congenital; that is to say, there is never more than a congenital tendency to paraphimosis arising from extreme tightness of the prepuce. It is a condition not uncommon in children. The prepuce gets accidentally drawn back, and cannot be returned: violent inflammation sets in, and paraphimosis is the result. I was once called in to see a child who had put a brass ring on his penis: a surgeon had been sent for before, but owing to the swelling he had not detected the ring. When I first saw the patient I was much alarmed at the excessive degree of inflammation and turgescence present, which had indeed risen to a height that threatened sloughing of the glans: the constriction of the part was so great that I at once suspected it to be caused by some mechanical force, and after closely examining the part, I detected the ring. With considerable difficulty I cut through it with a pair of nippers, and in a short time, under proper antiphlogistic treatment, the child perfectly recovered.

Balanitis, or external gonorrhœa, may produce paraphimosis: in that case the inflammation and uneasiness are at first but trifling, and they increase slowly; after a time, however, the inflammation becomes more acute, and the swelling and pain very severe. The first thing to be done in a case of paraphimosis is to endeavour to relieve the constriction by returning the glans within the prepuce: this may often be effected by taking the penis between the first and second fingers of both hands, and then pressing upon the glans with the thumb, draw forward the prepuce with the fingers at the same moment. This cannot, however, always be effected: in such cases ice ought to be applied, or perhaps blood taken if the patient be in a condition to bear it: if the symptoms be so urgent as to render it unadvisable to await the operation of the above means, the strictured prepuce must be at once divided. I usually make an incision on the dorsum of the penis, cutting carefully down to the corpus cavernosum; but Ricord has proposed a new operation: he tells us that the parts should be divided on both sides, and this for two reasons: there is not the same liability to hæmorrhage as when the incision is made in the centre of the dorsum, and at the same time the constriction is more effectually relieved. This must be evident, for it is caused by a deposition of adhesive matter in the subcutaneous cellular tissue, and by dividing it on both sides you necessarily produce greater relaxation by cutting into two parts of the adventitious matter instead of one. The operation for paraphimosis does not lead to so much deformity as is produced by slitting open a phimosis.

In the treatment of either urethritis or external gonorrhœa, Ricord recommends that in the first stage of the disorder we should employ what he calls "abortive treatment." He tells us that if corrosive sublimate or nitrate of silver be applied to the inflamed surface, the disease will be stopped at once; but it appears to me that these remarks can only apply to cases in which the disease had been produced by the action of a specific virus. We have already seen that the application of chemical or even mechanical irritants to the urethra will produce gonorrhœal discharge; we should therefore be led to expect that the use of bichloride of mercury or nitrate of silver in the manner recommended by Ricord, would be likely to aggravate the symptoms of the disease, instead of in any way checking or removing them: unless, indeed, the inflammatory symptoms be first subdued by strict antiphlogistic means.

When the inflammation reaches the lacuna magna it sometimes produces abscesses in that part: these I have even known to burst outwards, producing what may properly enough be termed a hypospadius, although that term is generally employed to signify a congenital malformation: when the abscesses burst in this manner, the opening heals up with very great difficulty.

In gonorrhœa there are five principal points in which the inflammation seems to develop itself as the disease progresses. These are, the fossa navicularis, lacuna magna, bulb of the urethra, membraneous portion of the urethra, and about the prostate gland. The inflammation which attacks these different regions is generally acute under all the conditions of gonorrhœa, but it sometimes passes into the chronic state. By means of the treatment I have already described,—viz., by bleeding, the use of antimony, the recumbent posture, and afterwards the mixture I have mentioned in an early part of this lecture,—I believe that most cases of gonorrhœa may be cured in from ten days to a fortnight: in some cases, however, the disease will, in spite of treatment, take the chronic form, and it will then be found very difficult to cure. When the disease has become chronic, injections of various kinds are recommended, but it seems to me that these fail quite as often as they succeed in producing a cure: indeed, the action of injections in gonorrhœa is a subject involved in obscurity, and always attended with more or less uncertainty.

Sedative injections will, however, probably be of more service when the inflammation is considerable, as they relieve the pain almost immediately. Liquor Plumbi Diacetatis, ♏xx.; and water, ℥jss., is a very good sedative injection. When thrown into the urethra it should be kept in for some time by compressing the end of the penis. When the inflammation is very severe, emollient injections may also be useful, as they impart to the internal surface of the urethra a protective coating against the irritative effect of the urine. Irritating injections must not be employed where there is much inflammation, particularly when there is any constitutional tendency to irritability, nor when the inflammation has extended to the testicles or bladder, which is known by the tenderness of the parts, and a constant inclination to pass the urine: they should also be avoided when there is a probability that the perineum will become implicated. Injections, however, often produce a good effect in constitutions that are not very irritable, and where the disease appears under a mild form. A grain of bichloride of mercury, in eight ounces of distilled water, is a good injection of this kind: its strength may be somewhat increased as the treatment goes on, if it should not be found effectual.

Gonorrhœa does not always confine its morbid influence to the urethra and neighbouring organs; various complications of the disease sometimes occur—such, for instance, as gonorrhœal ophthalmia; this is not, however, a common affection, and it even appears doubtful whether it be the consequence of a metastasis from the urethra: it certainly generally happens that during the discharge from the conjunctiva that from the urethra is checked, but it is not improbable that the effect may here be produced by the remedies applied to cure the ocular disease, and not from any metastatic action; and I am inclined to believe that ophthalmic gonorrhœa is only produced by direct contact of some of the matter from the urethra with the mucous membrane of the eyes, concurring probably with a catarrhal diathesis. This form of gonorrhœa must be treated in the same manner as the ordinary disease, excepting that the treatment must be more active, and if granulations spring up they must be immediately removed by nitrate of silver. I remember Sir Astley Cooper used to employ a lotion which he considered very efficacious in this disease: it was prepared by adding alum to milk, which was consequently separated into whey and a curdled mass, the former was employed as a wash for the eyes.

Rheumatism is another not unfrequent result of gonorrhœa; but it has been stated that it only occurs in cases in which balsam of copaiba had been administered. The copaiba seems to establish a tendency to inflammation of the synovial membranes; and those who advocate the use of cubebs in preference to copaiba employ this as an argument in favour of the former. I must acknowledge that in all the cases of gonorrhœal rheumatism I have seen, copaiba had been given in an early stage of the original disease; and, if it continue to be employed, it greatly aggravates the rheumatic symptoms. Such cases are not, however, sufficiently common to enable one to acquire much experience upon the subject. Gonorrhœal rheumatism is very difficult to cure, generally the subjects cannot bear depletion, and colchicum does not seem to exercise any influence over the disorder. Calomel and opium ought to be given, and iodide of potassium and liquor potassæ are also of considerable service. Indeed, any of the remedies which give tone to the stomach will be found useful in these cases, as they are always, I believe, marked by disorder of the digestive organs and bowels.

Stricture of the urethra is a common sequel to gonorrhœa; but it is not in the acute stage of the disease that stricture is produced. In the commencement of gonorrhœa you will rarely meet with more than spasmodic dysuria; permanent stricture is only the result of the chronic inflammation. When the submucous cellular tissue becomes inflamed, and this inflammation lasts for a long time, the capillaries take on a morbid action, secreting an adventitious matter, which encroaching upon the lining of the urethra, causes a narrowing of that canal, stricture being consequently produced. Some believe that stricture is the effect of using injections, but I do not myself hold this opinion. I think it rather arises from the morbid action being allowed to continue unchecked for a considerable time, and that the chronic inflammation brings about the change in capillary action I have described above. After the inflammation has taken on the chronic form, the urethra sometimes becomes so much altered in structure that the mucous membrane ulcerates, the urine extravasates into the cellular tissue, and an abscess is the result; this ultimately bursts, and if in the penis, leads to what I have already mentioned—a hypospadius or fistulous opening, very difficult to heal. The best mode of treatment is to draw off the water with a catheter for some time, and afterwards, when the inflammation has subsided, a plastic operation may be performed. This is sometimes successful, but cannot be relied upon. The inflammation in gonorrhœa sometimes extends itself to the prostate gland, producing pain in the perineum, and other urgent symptoms. This condition requires to be treated with active remedies; for if the inflammation be allowed to continue in the part, there is danger of its becoming chronic; this is very difficult to remove, and may, indeed, lead to abscess, and lengthened suffering. There is no form of disease resulting from gonorrhœa more distressing to the patient or more difficult to remove than chronic inflammation of the prostate gland. It is indicated by difficulty in micturition, deep-seated pain in perineo, intolerance of the sitting posture, and obstruction to the act of defecation. Cupping in the perineum, or leeches, calomel and opium, narcotic suppositories, and frequent use of the warm bath, are the means to be employed; during the treatment the patient should be kept in the recumbent position. In a late stage of gonorrhœal inflammation the testicles may become involved in the disorder; when this happens, orchitis, or inflammation of the testicles, is the consequence. This is supposed to be produced by metastasis of inflammation; and this view is strengthened by the fact that the discharge from the urethra ceases as soon as the inflammation in the testicle commences. It seems to me, however, that it is mere extension of inflammation, arising from direct continuity of structure; and it generally happens, when the inflammation has previously reached the prostate gland, it then extends along the vas deferens to the testicle, generally attacking the epididymis first. When the inflammation has reached the testicle the latter becomes swollen, and very painful; and there is hardening which is generally confined to the epididymis, often extending to the testicle, and even to the spermatic cord. It is said that in this affection the pain is dull and obtuse, and rather resembles that experienced when the testicle is squeezed. The discharge from the urethra stops when the inflammation in the testicles sets in. This latter condition must be relieved immediately; prompt treatment must therefore be adopted. Blood should be taken by cupping from the loins, and leeches afterwards applied to the scrotum, or a few veins may be opened on its surface. The following lotion may then be employed, the part being kept constantly wetted by it:

℞ Ammon. Hydrochlor. ℥j. to ℥jss.
Liquor. Ammon. Acet. ℥j.
Spirit. Vini rectif., Aquæ Distil., āā ℥j. M.
Ft. lotio sæpe applicanda.

In the treatment of orchitis arising from gonorrhœa I have always given calomel and opium, although it is generally said that mercury ought not to be employed. I have, however, found that if the inflammation be subdued by any other remedy, it is liable to return, which is not so often the case when calomel and opium have been given. It may be thought that opium alone would produce the same effect. I have myself tried it, and found it unsuccessful. Not that I give the mercury as a specific antidote to any virus; I only use it as an effectual means of preventing recurrence of the inflammation. Should the discharge from the urethra not return after the above treatment has been employed for the relief of the orchitis, hot fomentations should be applied for the purpose of producing its recurrence; and upon the reappearance of the discharge all symptoms of the inflammation of the testicle usually disappear.

In long-standing cases of gonorrhœa you will sometimes observe condylomatous growths about the scrotum, perineum, and verge of the anus: these can generally be cured by an application of the yellow wash; they often follow also upon a gonorrhœa, in cases where the disease commences externally—that is to say, in balanitis. In the first instance they are formed in points where the mucous membrane has been abraded, the warty granulations springing up from these points. Whenever these warts are present with phimosis, the prepuce must be laid open immediately: this is always necessary. Sometimes these warts are very difficult to cure. When they have narrow peduncular necks, a ligature may be used to remove them; in other cases, caustic or savine powder may also be employed as an escharotic. Sometimes, however, neither caustic nor savine powder will remove them; they must then be excised, and caustic applied to the surface whence they are removed.

Gleet.—Perhaps the most troublesome of all the consequences of gonorrhœa is gleet: this is the discharge which so frequently follows upon gonorrhœa, and often continues even for years. Gleet consists in a limpid discharge from the urethra, different from that in gonorrhœa: it appears to be, indeed, nothing more than an excessive secretion of mucus. Ricord states that the fluid in gleet cannot produce inflammation of the mucous membrane in another individual. I do not myself quite enter into his view, as I believe that any discharge of this kind may produce gonorrhœal inflammation in constitutions where there exists what has been spoken of as the catarrhal tendency or diathesis; and although Ricord states that a man may safely marry while suffering from a gleet, I do not think that such a proceeding would be justifiable.

Gleet is a very chronic disease, and extremely difficult to cure. I think it depends upon a thickening of the mucous membrane of the urethra, and an altered action of its capillaries, and on passing a bougie I have often felt a slight elevation at the bulb in these cases.

I have succeeded in curing gleet by passing a catheter besmeared with an ointment composed of ung. hydrarg. nitrat. ʒj, and ung. cetacei, ʒij: it must, however, be looked upon as a disease very obstinate and difficult to remove, and sometimes continues for the remainder of the life of the patient, particularly in persons of gouty diathesis.

Gonorrhœa is a disease to which women are equally liable with men, but in the former it is less distressing and painful, and it is also not so likely to lead to concomitant affections. There is generally some difficulty in ascertaining with certainty the existence of this disease in the female, from the liability to a discharge from the vagina very similar to that in gonorrhœa. It might be supposed that there would be no difficulty in distinguishing the discharge in leucorrhœa from that in gonorrhœa; but, in addition to the difficulty that always exists in distinguishing pus from mucus, it must be remembered that in leucorrhœa the fluid often puts on a pus-like character. The examination of the affected organs does not furnish the information we are seeking; it is stated by John Hunter, who had examined, in more than one instance, women who confessed to the disease, that there was no difference in the appearances of these and the organs in women perfectly sound. There are, however, two or three points by which the disorder may generally be recognised with tolerable certainty: first, the woman can produce a similar attack on men having intercourse with her; and, secondly, leucorrhœa is attended with symptoms that differ in many respects from those in gonorrhœa. With the latter disease women are seldom incapacitated from following their usual occupations, and it does not produce the great debility encountered in leucorrhœa, in which there is also pain in the back, lassitude, headaches, and painful menstruation. In women, gonorrhœa seems principally to attack the vagina, but at the same time it produces a great soreness of the inside of the labia and neighbouring parts, and thus produces difficulty in walking, and pain when sitting; the bladder, and even the kidneys, may become involved in the disease, and the glands of the part often swell, and occasionally small abscesses form in them, and burst into the vagina. The treatment of gonorrhœa in the female is in almost every respect the same as in man, but it is generally cured more easily.

LECTURE LXXIII.

SYPHILIS.

Virulent syphilis: origin of the disease—First local, becomes constitutional—May be propagated by inoculation—Poison of a specific nature—Kind of sore depends on peculiarity of patient's constitution, and the tissue affected—Early symptoms—Progress of sore—Chancres in women—Treatment of syphilis; by caustic, by mercury—Precautions under mercurial treatment.

In my last lecture, I finished the subject of non-virulent venereal disease, that is, gonorrhœa; I stated at that time that gonorrhœa may be produced by any irritating agent acting upon the mucous membrane of the urethra, but that it could never give rise to secondary or tertiary symptoms; it runs through the regular course of inflammation in the mucous membranes, and does not require for its cure the employment of any remedy which, like mercury, is supposed to exercise a specific action.

Syphilis, or virulent venereal disease, differs from gonorrhœa in many important respects: it is not, like gonorrhœa, a disorder of a peculiar tissue, and, although appearing locally in the first instance, is soon absorbed into the constitution, producing what are termed secondary, and tertiary symptoms. It is generally believed that the virulent form of venereal disease first made its appearance in Europe at the end of the 15th century: that it was brought over from the New World by the followers of Christopher Columbus, in the year 1493; some writers state, however, that the disease was well known, and prevailed among the ancient Jews, Greeks, and Romans, and among their descendants long before the time of the voyages of Columbus; but it does not appear that any mention is made by ancient medical writers, of a disease, the symptoms of which agree with those of virulent syphilis. It is true they describe a disease of the organs of generation which resembles gonorrhœa, but never one that produced constitutional effects of any kind, much less the violent and marked symptoms of syphilis. The period of the origin of syphilis is now, however, a matter of mere conjecture and speculation; and is, moreover, but of little moment. One thing, however, seems certain, that this disease originated solely in the human race, and that no other animal is capable of becoming influenced by the action of its peculiar morbid poison. A great number of experiments were undertaken by M. Ricord, for the purpose of establishing this fact. He inoculated in different ways dogs, guinea-pigs, rabbits, and even birds, but always with a similar negative result, although the purulent matter used in the experiments invariably produced syphilitic symptoms when tried upon the human subject. The result of these experiments led therefore to the conclusion, "that the inoculable poison of syphilis can act only upon the human subject, and that the disease cannot be communicated to the lower animals."

All experience of venereal disease seems to prove that syphilis is produced by a specific poison, which, if it be made to communicate with the blood in any part of the human body, produces the disease, which, in the first instance, gives rise to nothing more than a local action, but which subsequently affects the constitution. According to the opinion of John Hunter, this specific poison produces a peculiar irritation in the system, more or less modified "by the aptness of the living principle of the individual to be irritated by such a cause;" the part so affected taking on a specific action, elaborating virus in its turn, which can propagate the disease to other individuals by inoculation. It must be borne in mind, however, that the peculiarities of the constitution of the person affected by this virus must very materially modify its effects, in some instances, perhaps, resisting the infection altogether, and in all having an influence over the manner in which the disease manifests itself. No matter, however, what may be the modifications of the disease produced by peculiarity of constitution, a syphilitic sore can only be produced by the virus from an open sore, so that it may be considered as an axiom that a chancre is the only source whence another chancre can originate. Hunter thought that syphilis and gonorrhœa could be produced from the same poison, but there are few surgeons, I believe, who entertain that opinion at the present day; many experiments have been tried with the view of deciding this point, and all tend to prove Hunter's opinion to be incorrect. Sir Astley Cooper and Hernandez inoculated with gonorrhœal matter persons already infected with gonorrhœa. I have myself repeated this experiment, and have, moreover, placed lint dipped in the gonorrhœal discharge, beneath the prepuce; in the latter case, nothing more than balanitis, without ulceration, was the consequence, and when inoculation was tried, it produced simply a pustule, which soon healed in the usual way.

It certainly sometimes happens that secondary symptoms follow gonorrhœa, a circumstance sufficient to raise a doubt respecting the question of the virulence of gonorrhœa; in my opinion, M. Ricord has, however, quite explained the nature of this anomaly: he states that chancre within the urethra invariably accompanies such a condition: but the difficulty may still be said to remain, that one poison is producing both a virulent and a non-virulent disease; this is, however, not difficult of explanation, for a chancre may produce gonorrhœa by exciting mere irritation in the urethra, whereas gonorrhœa could never produce chancre, which is the local manifestation of specific diseased action.

It sometimes happens that in the same individual the chancres vary considerably in their aspect; this fact creates the important question, does there exist a plurality of poisons? or can the difference in the appearance of the sores be only accounted for by referring it to the effect of constitutional peculiarity, or to the nature of the tissue in which the sore is situated? It has been considered that climate has a great tendency to modify syphilitic disease, but I believe that climate has no influence over syphilis beyond that which arises from its alterative effect upon the constitution generally; change of climate may therefore be expected to aggravate or relieve syphilitic symptoms, according as it produces a deterioration, or improvement of the constitution. The effect of climate upon syphilis was noticed by many surgeons during the Peninsular war, when it was observed that our soldiers had syphilis in a highly aggravated form, compared with the persons by whom they were infected; my own experience in Spain and Portugal at the period I am speaking of, leads me to attribute the increased violence of the disease to the deteriorating influence of a hot climate, and the manner of living in a country where wine and spirits are so abundant and cheap, and not to any modification of the disease itself. In proof that syphilis is greatly under the influence of extraneous circumstances, I may state the fact that the virus from the mildest kind of chancre may produce in another individual the most violent form of syphilis, and *vice versâ*. This is a circumstance which to my mind tends very materially to overthrow the doctrine of the existence of more than one specific poison, each producing its particular kind of sore. If there were more than one syphilitic virus, each producing a sore peculiar to itself, then the virus from these sores ought to reproduce each the special kind of sore whence it was taken, and no other; such is, however, abundantly proved not to be the case.

Hunter seems to have entertained the opinion that syphilis could only have arisen originally from sexual intercourse, for as the primary disease is always found on the organs of generation, unless the chancre be factitiously formed by inoculation, the origin of the disease must be a disease of the genitals, for the secondary form of this disorder, even if it be ulcerative, is not inoculable. It might certainly happen that a common sore might be converted into a chancre by inoculation with the virus of a syphilitic ulcer; and Ricord mentions that in Paris primary chancres are frequently seen on the lips, anus, and other parts of the body.

Children are not unfrequently affected with primary symptoms immediately from the time of their birth. This can only arise when the mother is the subject of chancre, the child being inoculated with the virus by contact with the sore during the time of parturition; the primary is not, however, the usual congenital form of syphilis: if the mother be affected with any of the varieties of secondary symptoms during the period of pregnancy, the offspring may be similarly affected at birth; this is the only instance in which secondary symptoms can be transferred from one individual to another, unless, as some persons have supposed, a similar result can be produced upon a child imbibing the milk of a contaminated wet nurse; but at most, this is, I think, a doubtful point.

The nature of the morbid action which produces syphilis is quite unknown. This is likewise true, so far as regards the virus itself, which, like the morbific principle of other inoculable diseases, is beyond reach of our observation. Neither the science of chemistry nor the microscope have hitherto given us any assistance; Dr. Donné thought that the origin of the disease could be traced to the presence of animalculæ (vibriones), as he discovered them in abundance in the virulent matter of a chancre. These animals are found, however, in almost every one of the secretions, healthy or morbid, under certain conditions, and their presence in the discharge from chancre is, I think, totally unconnected with the specific nature of the virus. From the sum of all the observations made upon this disease in its different phases, we may come to the conclusion that the primary disease is invariably an open ulcer, the chancre which secretes a virus competent to propagate the disease to another individual. Unless this primary disease be removed from the system by proper medical treatment, it excites various constitutional symptoms, termed secondary symptoms, or Lues venerea.

The usual appearances of chancre are characteristic, but at the same time it must be observed that the principal physical marks of the disease are seldom all present in the same chancre, at the same time, for although the sore is always specific, it is, as I have stated before, subject to considerable physical modifications, owing to the peculiar constitution of the patient. The immediate effect of the virus also depends, in some degree, upon the depth to which it is introduced into the tissues. Ricord states, in proof of this, that although when the disease is communicated in the usual manner, that is, by contact, only a pustule is produced, when the virus is applied to a denuded texture an ulcer is established at once, and if the abrasion be deeper, extending into the cellular tissue, an abscess will be the consequence of the introduction of the virus. A knowledge of these circumstances shows the surgeon the necessity of inquiring into the condition of his patient at the time he became infected, as this will perhaps explain the reason why the disease made its appearance either with unusual rapidity, or, on the other hand, was slow in its progress after the sexual intercourse; it must likewise be remembered, in judging of a chancre by its physical characters, that its appearance does not depend entirely upon the specific disease, but in some degree upon the common inflammation arising from the local irritation produced by the presence of the chancre in the surrounding tissues.

A longer or shorter time always elapses after infection before the virus seems to have acquired sufficient power in the system to produce its specific manifestations; under ordinary circumstances a chancre appears from ten to fifteen days after infection; its first form is that of an itching pimple rising from some part of the penis; in the course of a day or two the pimple becomes a pustule, the summit of which ulcerates and begins to discharge matter; the rapidity with which the inflammation runs into ulceration and suppuration is a strong diagnostic mark of syphilis. Sometimes the matter hardens and forms an incrustation or scab on the pustule; when this is rubbed off, it leaves an ulcer exposed, which has a tendency to deepen, rather than to extend itself laterally; the edges of the ulcer are elevated and hard, its surface is covered with a yellowish grey secretion, which emits a peculiar fœtid odour, and the base of the sore is of a scirrhous hardness, as if it were formed of cartilage; an areola of inflammation also surrounds the sore, but this is probably at first only common inflammation, which becomes specific from contamination with the virus of the sore as the disease extends itself.

The usual form of a chancre is circular, but this depends upon the situation of the sore, and the firmness of the attachment of the mucous membrane to the subjacent tissues; thus a chancre extending from the glans to the mucous membrane of the prepuce, exhibits great irregularity of form in consequence of the unequal attachment of the mucous membrane to the interior of the prepuce and the surface of the glans. Another cause of the irregularity of form in chancres arises from the manner in which the ulceration extends itself from one sore to another, uniting them in one irregular ulcer. The depth of a chancre is greater when it is on the prepuce than when it is on the glans; the structure of the latter seems to have a great power to modify the appearance of the sore: preventing, perhaps, from its high degree of vitality, the progress of the ulceration in depth, it consequently extends itself laterally, producing a sore of considerable superficial extent. A chancre such as I have described, with the peculiarly hard base, may be regarded as the true Hunterian chancre; it is but seldom, however, as I have already stated, that we have the opportunity of witnessing all these appearances in the same chancre, and, indeed, the character of the sore is sometimes so far modified that it is difficult to determine whether it be syphilitic or not. The chancre is sometimes characterized by a remarkable sensitiveness of its surface, and its tendency to bleed; such a chancre is termed an irritable chancre; it requires peculiar treatment, which I shall have to describe at a future time.

The irritable state of the chancre often runs on to a phagedænic form, in which the sore extends with great rapidity, involving the surrounding tissues in a devouring ulceration, so that in the course of a few hours only, a sore may increase to double its size. If the inflammation goes on to an excessive degree, a syphilitic sore, like one arising from any other cause, may take on a gangrenous action; according to Ricord, when in that state the sore no longer secretes a virus. Still the patient must be subjected to the usual treatment, to prevent the liability to secondary symptoms. These varieties of chancre depend, according to the opinion of Carmichael and some others, upon the peculiar nature of the virus which caused them; but I believe, with John Hunter, that there is only one specific syphilitic virus, and that the conditions of the sore depend upon the constitution of the individual infected and the tissue which first received the inoculation. A proof that morbid poisons are much modified in their manifestations by the constitution in which they take root may, I think, be found in the great variety of appearances and character assumed by the pustule produced in small-pox and vaccination; yet in these cases care is taken that both the person inoculated and the one from whom the matter is obtained should be in the most favourable condition; some have believed that the violence of the symptoms depend upon the intensity of the virulence of the poison as well as upon the peculiarity of constitution in the recipient; and Mr. Wellbank went so far as to believe that in syphilis the nature of the secondary symptoms was in relation to the intensity of the original poison.

In addition to the different forms of chancre there are other sores which appear upon the penis and other parts of the genitals, and which either arise idiopathically or are produced by sexual intercourse; these may differ from chancres, being, perhaps, aphthous sores, like those which appear on the cheeks and tongue, or otherwise red raised sores, having more the appearance of deposition than of ulceration, or mere excoriations, attended sometimes with induration; sometimes, again, herpetic vesicles extend into each other so as to produce a continuous denuded surface. It is impossible, from the appearance alone of any of these sores, to say that they are or are not virulent. The presence of the indications whicy mark what I have described as the Hunterian chancre, is certainly sufficient evidence of the virulence of the disorder; but the absence of these characters must not, on the other hand, be considered as a proof of its being innoxious. I have more than once known secondary symptoms follow the healing of a sore which was cured without the employment of mercury; this shows the fallacy of the opinion that the healing of a sore without mercury may be taken as a proof of the disease not being syphilitic.

We see that it is not from the physical conditions of a sore that we can distinguish whether it be virulent or non-virulent, and, as Ricord has well observed, the only positive means of gaining this knowledge is the inoculation of the patient himself with some of the discharge from the suspected sore. In my own practice I think I have come to the conclusion that induration approaching to cartilaginous hardness at the base of the sore is almost always an indication of its virulent nature, and that, generally speaking, if mercury be not adopted in such cases, secondary symptoms will supervene. The abundant testimony that syphilis can be cured without mercury must make a strong impression upon the mind of every surgeon, and there are few, I presume, who would venture to contend that the circumstance of a sore being cured without mercury is conclusive evidence of its not having been syphilitic. It has been asserted by some medical men of sufficient ability to give them authority upon the subject, that syphilis may even undergo spontaneous cure; now this could only happen in consequence of the constitution becoming naturally improved or elevated, so that it is enabled to throw off the disease; if this be really the case, we can readily believe that any alterative medicine strong enough to produce the necessary change in the constitution, would at the same time excite that general curative action by which the disease may be subdued, exactly in the same manner as when the cure arises spontaneously; hence comes the question as to the nature of the operation of mercury in syphilis, whether it act upon the disease primarily as a specific, or secondarily as a constitutional alterative? The surgeon should ever on such points as this keep himself free from prejudice; in the present instance it would be folly, on the one hand, to assert that mercury is infallible in every form of syphilis; on the other, to sweepingly condemn its use. Other remedies besides mercury may have power over this disorder. At least we should always keep our minds open to this conviction; it leads to more scientific and general views of the subject. At any rate, John Hunter's idea that syphilitic disease never wears itself out in the constitution must be viewed with great caution. Mr. Rose has published an account of his treatment of syphilis in the soldiers of the Guards during a period of a year and three-quarters without mercury, the symptoms being both primary and secondary: his plan consisted in simple dressing, confining his patients to bed, and giving occasional purgatives: in one-third of the cases secondary symptoms followed the healing of the chancre, but they were considered milder than when mercury had been administered to cure the primary disease. It is important to remark, that in no instance did caries of bone follow the treatment of these numerous cases. Sir James McGrigor and Sir William Franklin signed an official circular, in which were given the results of the army practice during two years; 1940 cases were treated and cured without mercury; the chancres were cured in twenty-one days when there was no bubo, but with bubo they required forty-five days; 2827 cases were cured with mercury, the chancres healing in thirty-three days without bubo, but requiring fifty if it were present.

This statement is somewhat at variance with the results obtained by Mr. Rose and others, as it is always admitted that when mercury is employed, if no other advantage be gained, the disorder is cured more rapidly than under other treatment. I confess I am also surprised to find it stated in the report above mentioned, that the greater part of the 2827 chancres were Hunterian, a form of sore which I consider very rare.

The results quoted from authorities certainly show that, under modifying circumstances of constitution, structure infected, or even perhaps of the virus itself, syphilis may be cured without mercury; this does not, however, prove that mercury is not an excellent remedy, when administered with judgment, with respect to quantity and manner of exhibition; it is no longer considered necessary that ptyalism should be excited to a violent degree, and that the benefit derived from the medicine was in proportion to the quantity of saliva secreted; those were the days in which diseased bones and permanently undermined constitutions were a common sequence to mercurial treatment, and it was from this kind of abuse rather than use of mercury that it fell into discredit. Those, especially the army surgeons, who profess to treat syphilis without mercury, give iodine, iodide of potassium, arsenic, nitric acid, and remedies of that class, which seem to have the most powerful influence over the constitution, and which must be considered to act as alteratives. It may be true that mercury acts in this manner and not as a specific antidote to the poison; perhaps this is the most rational view; granting such to be the case, all I can say is, that I have always found mercury a most safe and effectual medicine.

The non-mercurial remedies seem to have the effect of stifling the disease, as it were, for a time, but they do not eradicate it; and as soon as the treatment is discontinued the symptoms make their appearance again; while, on the other hand, the action of the mercury seems to be sufficiently strong to destroy entirely the seeds of the complaint. After all, the question whether or not mercury acts as a specific is but a profitless one, and practically it comes to this simple point—Is mercury a more effective remedy against syphilis than other alteratives? If this be the case, and if at the same time there be no circumstances to contraindicate the use of mercury, it is clear that it ought to be employed; the experience of thirty years has brought me to the conclusion that it is superior to other remedies, and in my own practice I always rely upon it accordingly.

In the treatment of common chancre, my practice is first to ascertain the period at which the sore appeared after sexual intercourse; secondly, to gain as much knowledge as possible of the patient's constitution; and, lastly, to examine the sore itself, so as to learn its physical peculiarities. If I have an opportunity of seeing the sore within five days after the time of infection, I, according to the plan of M. Ricord, destroy its surface with concentrated nitric acid, for I believe, with him, that it is not until after five days that the constitution begins to receive the impression of the disease, or that, perhaps, the sore itself before that time has not arrived at the state in which it can secrete a virus; the disease is therefore at that early period entirely local, and may be completely destroyed by the action of the powerful escharotic I have named. John Hunter was in the habit of excising the sore when in its first stage, but I think the acid is more certain in its operation, as in making the incisions it is possible that the virus, should it have been generated, may become mixed with the blood. I have in many cases thus destroyed recent sores with nitric acid, and have never known secondary symptoms follow. If more than five days have passed before the chancre is brought under my treatment, and I find neither constitutional nor local circumstances to forbid the use of mercury, I employ at once that remedy. Perhaps I ought to mention here the circumstances which would govern my judgment in administering mercury. If the patient were extremely debilitated, I should prescribe vegetable bitters with mineral acids, together with small doses of the hydrarg. c. creta and Dover's powder at bed-time, so as to improve the state of the constitution before I gave the mercury in an efficient form; or if, from general symptoms and the appearance of the tongue, I had reason to conclude that the mucous membrane of the primæ viæ was in an irritable state, I should order a drachm of blue ointment to be rubbed into the thighs night and morning, instead of giving the mercury internally. I should at the same time abstain from applying any dressing to the sore beyond a piece of linen rag, dipped in warm water; for as the surface of the sore presents peculiar and characteristic syphilitic indications, such as being covered with a greyish yellow matter, and with a tendency to ulcerate deeper and deeper into the tissues, it is my object to watch the sore uninfluenced by any other agent than the constitutional effect of the mercury itself; while, on the other hand, if black wash or nitrate of silver be applied, these specific appearances are immediately lost, and we are deprived of a valuable guide whereby we may judge of the constitutional effects produced by the mercury. While under the influence of the mercury, the patient should avoid all vicissitudes of temperature, and should keep, as much as he can, in the recumbent posture. It is very difficult to get patients to submit to this strict discipline, some parts of which are certainly irksome and disagreeable. When the blue ointment is used, the patient ought to constantly wear the same drawers, that they may become impregnated with the ointment, as the object is to keep up the influence of the mercury as continuously as possible. As this is an unpleasant and not very cleanly process, I prefer giving the mercury internally, unless there be reasons against it. In administering the mercury in the form of pills, I give five grains of blue pill, with a quarter of a grain of opium, at bed-time, and five grains of blue pill, without opium, in the morning; if, in the prosecution of this plan, it be perceived that the opium constipates the bowels, the patient should only be allowed to take blue pill at bed-time as well as in the morning; while if he be purged, he should have opium with the blue pill both morning and night; thus by proper attention the bowels may without difficulty be kept quite regular. I also avoid, under these circumstances, as well as when the mercury is used as an external application, any local treatment of the sore; for the reasons I have already stated.

At this point there arises a question of some importance: How long is the exhibition of the mercury to be continued? I believe the only guide as to this part of the treatment is to be found in the condition of the sore itself. While any induration remains about the base of the chancre I continue to give mercury, no matter what change may have taken place in the surface of the sore. I only give the mercury, however, in small doses, so as to avoid any cumulative effect which may perhaps be the consequence of overdosing. If the hardness of the sore be not removed by the internal use of mercury, a small quantity of blue ointment may be applied to the sore itself, or even to the cicatrix, should the sore be healed and the hardness still remain. Under such treatment, with the proper precautions as to diet, rest, and avoidance of cold, as I have described before, I have rarely met with difficulty in curing primary chancre.

In the *irritable chancre* the chief peculiarity is the sensitiveness of the surface and the disposition to hæmorrhage. These are, however, merely circumstances superadded to common chancre, produced by constitutional peculiarities: the first object is, therefore, to remove those characters which are not specific to the disease, and this must be done by constitutional remedies, the ulcer being reduced to the state of a common chancre. The first indication is therefore to seek the cause of the irritability; this will be often found to depend merely upon a constipated state of the bowels, aggravated perhaps by a nervous temperament: slight purgatives, combined with soothing medicines, are required in such a case; if these be not sufficient to remove the irritability, local applications must be tried; three grains of opium, well rubbed down with half an ounce of mucilage of gum arabic, and an ounce and a half of lime water, make an excellent topical application; the penis must likewise be well fomented with a decoction of poppy-heads; the patient should also be kept strictly in the recumbent posture. Such treatment seldom fails to overcome the extraordinary circumstances of the case, leaving the chancre to be cured by the ordinary mercurial course. It will, however, be found that a patient whose diathesis leads to this condition of sore, requires to be treated generally with much more care than one whose temperament has a less irritable tendency.

The *phagedænic chancre* bears very considerable resemblance to the irritable, both in its physical and constitutional characters; the chief distinction is, perhaps, that the irritable chancre depends most upon constitutional, and the phagedænic upon local irritability; there may, however, be something like a combination of the characters of both. In the treatment of phagedænic chancre, we must first ascertain the state of the bowels; if constipation be concomitant with phagedæna, gentle purgatives must be administered with sedatives; should these not prove effectual, concentrated nitric acid should be applied to the sore; this generally stops the ulceration and establishes a healthy action, after which the sore soon heals. If the surgeon who orders nitric acid had only seen the sore for the first time, after the phagedænic ulceration had set in, he would find some difficulty in determining whether it had originated in syphilis, and consequently whether mercury ought to be administered. In such cases, I judge of the syphilitic character of the sore by the hardness of the cicatrix; if the peculiar induration which I regard as a sign of syphilis be present, I give small alterative doses of the bichloride of mercury with bark, warning the patient that secondary eruptions are not unlikely to show themselves. I adopt this plan of treatment, in preference to giving mercury in a stronger form, when the constitution is evidently in a depressed state. M. Ricord believes that a phagedænic sore does not secrete virus; even if this be true however, it must be remembered, that the poison may have been secreted and absorbed before the sore became phagedænic.

I lately attended a case of this kind with Mr. Parrot, jun., of Clapham, who had carried the use of sedatives and tonics to the fullest extent, paying due attention at the same time to the state of the bowels, without being able, however, to check the progress of the disease. One application of nitric acid by the point of a glass rod proved sufficient to check the ulceration; and under the subsequent exhibition of mercury, the patient perfectly and permanently recovered.

In the *gangrenous form of chancre* the same reasoning which I have applied to the irritable and phagedænic sores relates in equal degree; it depends, as they do, upon peculiar local and constitutional circumstances independent of the syphilitic taint, and indicating a general asthenic state of the constitution; hence, therefore, after the bowels have been opened, stimulating poultices should be applied to the sore, the patient being kept in the recumbent posture; ammonia, wine and bark, or serpentary, are generally indicated as internal remedies, although in some few cases I have seen gangrenous chancre in constitutions in which stimuli could not be employed, and where indeed it was necessary to depend on sudorifics and opiates.

In concluding this part of my subject I may perhaps make a few remarks upon the influence of situation on chancre; it will be found that the appearance of the sore depends very much upon the character of the tissue in which it is placed; for instance, on the glans penis it has usually a tendency to spread superficially rather than to excavate the part, and the hardness of the base of the sore is less marked and circumscribed than when it occurs in other situations. A chancre in the meatus of the urethra is often very difficult to heal, which seems to depend in some measure upon the irritation caused by the urine flowing over it. In some cases I have found it very useful to divide slightly the margin of the orifice of the urethra; this not only assists in healing the sore, but prevents it from spreading to the whole circumference of the meatus. Chancres, when situated on the external surface of the prepuce, have a peculiar tendency to the pustular form and to scab over, probably from the influence of the external air and the non-confinement of the secretion. Under the prepuce and around the corona glandis the ulcer is comparatively superficial, and has a disposition to spread laterally; the sore is also continually covered with moisture, and rarely puts on the characters of the true Hunterian chancre. The chancre of the frænum is very peculiar, and almost invariably destroys the part. It is a contested point whether the frænum ought to be divided or not; for my own part I think it right to do so, as it seems to check the disease by promoting the healing of the sore. In the same individual chancres may be coincident in all the situations I have mentioned; the general opinion is, that the violence of the disease depends upon the number of chancres, and this is in some degree my own opinion, although Ricord believes that the number of sores neither increases the liability to secondary symptoms, nor leads to their aggravation should they follow the primary disease.

LECTURE LXXIV.

CONTINUATION OF SYPHILIS.

Bubo, may be the consequence either of gonorrhœa, or virulent venereal disease—Characters of bubo; its seat—Non-virulent bubo; its tendency to suppurate—Treatment of non-virulent bubo—Virulent bubo—Use of mercury; opening a bubo—Secondary symptoms—Indications of; treatment—Chronic sore throat—Cutaneous eruptions—Syphilitic iritis—Syphilitic disease of the bones.

Hunter, believing that gonorrhœa was a syphilitic disease, must likewise have thought that the swellings in the groin, buboes as they are termed, were similar in character when caused either by gonorrhœa or by chancre, although it must be observed that he does not mention any case of secondary symptoms following bubo, caused by gonorrhœa alone. It may, however, happen, that secondary symptoms may supervene upon what is supposed to be gonorrhœa, but in such a case there can be no doubt that a chancre is present in the urethra, and hidden from view. Under these circumstances, gonorrhœa and chancre may be present at the same time, and then of course a bubo, which is apparently the result of gonorrhœa only, may be virulent, and followed by secondary symptoms. Upon this subject I agree entirely with Ricord in believing that secondary constitutional symptoms can never make their appearance without chancre having been originally present. Another difficulty may at the same time arise with respect to the formation of a bubo: for example, a patient may have a chancre, the mere irritation from which may be sufficient to produce a bubo, although the virus of the chancre may not have become absorbed; swelling of the glands would in that case arise only from common irritation, and would be identical in its character with a gonorrhœal bubo. Of course, such a bubo is non-virulent, and if a patient were inoculated with the matter, no specific sore would follow.

It is obviously very important to form a just diagnosis between bubo arising from the true syphilitic or virulent action, and that which is the result of irritation only, as in gonorrhœa; for whereas the gonorrhœal bubo requires nothing beyond the treatment of common abscess, in addition to the usual means of allaying the irritation arising from the gonorrhœa itself, in the syphilitic bubo the same treatment must be employed as is indicated in a syphilitic chancre—which indeed a virulent bubo must be considered to be as soon as it has put on the ulcerative action.

A virulent bubo is marked by the same characteristic hardness as a chancre, and the presence of this induration would always of itself raise the question of the virulence or non-virulence of the swelling. Ricord says there is as much difficulty in forming a diagnosis between the syphilitic and gonorrhœal bubo as between the syphilitic and non-syphilitic sore; and he remarks, further, that the only sure diagnostic distinction between them is inoculation with the pus, although he admits at the same time, that there are indications by which a pretty accurate opinion may be arrived at. For instance, gonorrhœal or sympathetic buboes, as they are often called, usually affect several glands, and more or less constitutional derangement accompanies them. We must attend closely to the character of this constitutional disturbance, as a tendency to struma may itself be the principal idiopathic cause of the formation of bubo, and if this were the case, the treatment of the latter would be regulated accordingly. Syphilitic bubo is generally seated in one gland only; or should more than one be affected, Ricord believes that only one is virulent, and that the others are merely the result of the irritation of the chancre. The poisonous taint is found to be confined to the gland nearest to the chancre, and it is from this that the matter is to be taken for inoculation, if it be determined to try that experiment as a means of diagnosis. It is a curious circumstance that the poison does not extend from one gland to another, and shows that a gland possesses a remarkable power of retaining the poison of syphilis—a power which it certainly does not possess in malignant disease: for then it is common for the lumbar glands to become affected by extension of the disease from those of the inguinal region.

The non-virulent bubo has a tendency to suppurate at a very early stage, while the virulent bubo passes very slowly into a state of suppuration; and its sluggishness and permanent hardness may be taken as a further proof that it originated in a virus. When once the syphilitic bubo has suppurated, it soon goes on to ulceration; this change is attended by acute pain, and the ulcerated surface puts on all the physical appearances of a chancre, and, as I have said before, the matter from such an ulcer is inoculable.

The common gonorrhœal bubo must be treated as a phlegmonous swelling in any part of the body, that is, either by repellents to prevent the formation of matter, or by fomentations and poultices to promote it. By repellent remedies, I mean those which tend to prevent the secretion of pus, as leeches and evaporating lotions; by the employment of these we may succeed in suppressing suppuration, but still there may remain a permanently hardened state of the bubo, which may excite suspicions of its virulence, of its having perhaps originated from a chancre within the urethra. Such an indurated bubo may, however, be produced by a scrofulous tendency in the constitution; if so, the hardness will yield to the exhibition of iodine and iodide of potassium, and such a system of diet as usually improves a strumous constitution; if the hardness depend, however, upon the action of a specific poison, a course of mercury is, I think, the only safe treatment. In my own practice, when a bubo puts on the signs of a virulent origin, I begin at once with the cautious administration of mercury, sometimes using iodide of potassium combined with it. I refrain from applying any local remedy to the surface of the ulcer; I explained my reason for this, when speaking of the treatment of chancre: if the mercury produce the desired effect, the ulcer becomes covered by soft, red granulations; the edges have no longer a tendency to be everted, and the base of the swelling undergoes a general softening. The mercury should be continued perseveringly until all induration has disappeared, in the same manner indeed as the mercury is given in the treatment of a primary chancre, or secondary symptoms will be pretty sure to make their appearance at a later period. In opening a bubo, the same precautions must be taken and the same means employed as in opening common abscess. The opening should not be made until the most suitable period has arrived; that is to say, not until the suppurative process is quite completed; this may generally be known by the fluctuation, and by the change in the colour of the skin from a vivid to a dull brownish red; also by the pain losing its acute character, and becoming dull and throbbing; the rigor which marked the progress of suppuration will likewise have entirely ceased. The sharp-pointed bistoury, termed a phimosis-knife, is the best instrument for opening a bubo, as it makes a sufficiently large puncture to permit of the ready evacuation of the pus without pressure. In chronic non-virulent bubo, when the suppuration goes on slowly, I have found it a good plan to make three or four small punctures, allowing the matter to exude very gradually, and afterwards applying gentle pressure; this method affords the advantage of an effectual evacuation of the matter, without leaving a large scar. After the matter has been let out of the bubo, it sometimes happens that the skin ulcerates; this ulceration may be the consequence of a virulent action, but we must be careful not to mistake for a specific ulceration what only depends upon the destruction of the subjacent areolar tissue. Of course we must, in such a case, judge as well as we can by collateral circumstances, that is, whether there be other signs of the existence of syphilis. However careful and prompt we may be in the treatment of primary syphilis, it sometimes happens that although the chancres heal, secondary constitutional symptoms manifest themselves after the lapse of a certain period. My experience in the treatment of this disease shows me that the occurrence of secondary symptoms is to be traced to the discontinuance of mercury before the induration of the sore had been overcome, or to some constitutional peculiarity which interfered with the usual operation of the mercury. We may suspect the cause of our failure to be constitutional when the virulent ulcer remains unchanged in appearance after mercury has been given for the usual period. If the mercury also fail to produce ptyalism, I stop the use of it internally, and cause the patient to rub in the mercurial ointment; this must be continued until the induration of the sore is completely removed. If these means all prove insufficient to eradicate the virus from the constitution, there can be little doubt but that secondary symptoms will sooner or later make their appearance; these are usually the sequence of primary chancre, consisting, indeed, of the constitutional development of the disease. Secondary symptoms may, however, be hereditarily transmitted from parent to child, and this is the only way in which secondary symptoms can be propagated from one individual to another—at least such is generally thought to be the case—but at the same time. I think that a person affected with secondary symptoms ought not to marry; the risk would render the step an unjustifiable one.

Secondary symptoms, when they follow the uncured primary affection, in consequence of the admixture of the virus with the blood, do not, as Hunter has said, seem to produce a general constitutional effect, for during the influence of the poison every vital function seems to be perfectly performed; but owing to the susceptibility of certain parts to be affected by the venereal poison, a train of local symptoms present themselves: thus, the mucous membrane of the throat and tonsils, the skin, mucous membrane of the mouth, nose, and the iris, seem to be successively affected. It has been said that there is a second order of parts liable to be consecutively affected—as the periosteum and fibrous tissues generally, even the bones themselves,—but I am inclined to believe that such affections depend upon the action of mercury in peculiar constitutions, especially in those of a rheumatic or gouty diathesis. Under ordinary circumstances the parts which seem especially prone to be affected by this form of syphilitic disease are mucous membranes and skin; and, as far as I have seen, the sore throat generally precedes the cutaneous eruptions. From about six weeks to two months, and even sometimes longer, after the primary symptoms appear to have been cured, the patient generally begins to complain of an uneasy sensation in swallowing, attended with more or less dryness about the fauces. Upon examination an erythematous blush will be seen extending over the mucous membrane of the soft palate and tonsils, but which can scarcely be distinguished from the inflammation concomitant with simple sore-throat; unless, perhaps, it may be said that the mucous membrane has somewhat the appearance of being raised from its subjacent tissues, and that it is less vivid in colour than in common inflammation, and this is unattended by enlargement of the tonsils themselves.

When I see these symptoms, I at once examine the cicatrix of the primary sore, and also the chest and abdomen, to ascertain if there be any venereal blotches. If I learn from the history given by the patient that there was reason to believe that the mercurial course had been judiciously attended to, I prescribe the following mixture :—

℞ Iodini, gr. ss.
Potass. Iodid. ʒss.
Papav. Syrup, ℥ss.
Inf. Gentian. co. ℥viiij. M.
Capiat cochl. larga, ij. bis quotid.

Where I have any doubt of the accuracy of the patient's account of his case, I prescribe, in addition to the above mixture, three grains of Plummer's pill at bed-time.

If the part has begun to ulcerate,—and this usually commences on one of the tonsils, or in the velum palati or uvula,—I first prescribe the mixture as above, and if the sores then heal, and the patient be of delicate constitution, I give him bark, with nitro-muriatic acid, to improve his general condition; and should the symptoms of sore throat again return, I order Donovan's solution, as follows:

℞ Sol. Iodid. Hydrarg. et Arsenici, ♏v.
Sarsæ Ext. grs. x.
Sarsæ Decoct. co. ℥jss. M.
Ft. haustus bis quotid. sumendus.

This remedy I have found of the greatest use, and in these cases it far surpasses, in my opinion, the iodide of potassium, which seems to suspend the diseased action for the time rather than to remove it from the system.

The erythematous syphilitic condition of the throat, which I have just described, sometimes passes into a chronic form, and then seems especially to attack the mucous membrane covering the middle constrictor of the pharynx : the true erythematous blush can scarcely be recognised, but the membrane puts on a streaky white appearance, and the patient complains more of an uneasy dryness of the throat than of pain in swallowing : if this condition be not removed, cutaneous eruptions are almost sure to follow. I give, therefore, Donovan's solution in these cases, and not unfrequently paint (with a camel-hair brush) the affected mucous surface with the solution of nitrate of silver.

I have sometimes known patients thus affected become quite deaf without any enlargement of the tonsils, which leads me to believe that the inflammation sometimes extends along the Eustachian tube. In some few cases I have found it extremely difficult to cure ulcerations of the throat resulting from secondary symptoms; and in these, the remedies I have described seem almost inefficient. This occurs more especially when ulceration extends to the mucous membrane of the larynx, and probably the difficulty arises from the continuous motion of that organ, which interrupts nature's efforts at reparation. I have found the fumes of the red oxide of mercury, inhaled by means of an appropriate apparatus, very effective in these cases; and I believe, should this not have the desired effect, nothing is left to be done but to perform the operation of tracheotomy, with the object of placing the inflamed and ulcerated mucous membrane in a condition in which it can remain in a perfect state of rest; as unless the ulceration is checked, the death of the patient must inevitably take place.

I acknowledge that I have never myself performed the operation of tracheotomy with this view, but I once advised its adoption in the case of a gentleman at Woolwich : he would not, however, consent to its being performed, and died six weeks after, from the continued progress of the disease.

In ulceration of the tonsils it is often difficult to judge, by the physical conditions of the sore, whether it arise from syphilitic taint or otherwise; in the absence of general venereal symptoms, particularly if there were any indications of struma, I should give the iodide of iron or iodide of potassium and bark, and order also nutritious diet; the patient should likewise, if possible, have the benefit of sea-air, and use a simple gargle for the ulceration in the throat; if, however, any doubtful cutaneous eruptions were found accompanying the ulceration of the tonsils, and the history of the case connected this local disorder with syphilis, gentle doses of mercury should be prescribed, such as the hydrarg. c. creta, with Dover's powder and bark, if tonics were indicated by the patient's state of constitution.

Venereal cutaneous eruptions.—In this form of "secondary symptoms" a doubt always arises in my mind as to whether the eruption can be attributed to the immediate action of syphilis, or whether it may not be regarded as the result of a constitutional tendency, only developed by the action of the syphilitic poison, and the appearance of the eruption being also modified by the same agency.

Carmichael thought that this kind of eruption depended upon the peculiar poison of the virus. Thus he imagined that the elevated chancre without induration produced the pustular eruption, phagedænic sores the tubercular; and common chancre the scaly eruptions. I have never, however, been able to make up my mind that the different conditions of sore are followed by any particular kind of eruption, but believe that the constitutional differences which lead to the variety which we witness in sores themselves lead equally to the development of the various kinds of eruptions.

Perhaps the most common form of cutaneous eruption in syphilis is the papillary, as lichen, which is to be distinguished from the idiopathic disease by the dirty copper-brown colour of the skin, and the peculiarly superficial appearance of the stain, which gives the idea that it may be easily removed by washing. It is also much less irritating than the ordinary disease. The papular is the form which the disease usually assumes in children. This eruption will sometimes pass into the pustular form, which renders its classification difficult; but still the specific colour sufficiently stamps it as a venereal eruption.

In this form of eruption, Plummer's pill and large doses of sarsaparilla are the remedies which I generally employ: sometimes, however, I give small doses of the bichloride of mercury, with the sarsaparilla, in the place of the Plummer's pill. Slight antiphlogistic means ought, however, to be used before we commence with these remedies.

I think I have found the scaly eruptions appear next in order in point of frequency to the papular just described, and have sometimes seen pityriasis in the first eruption of venereal disease; but the character of the disease is then likewise marked by its peculiar copper colour: it sometimes commences as a smooth elevation or as a dirty blotch before it passes into its scaly condition.

Lepra and psoriasis are also common forms of secondary scaly eruptions, modified, however, in appearance by the venereal poison.

These squamous diseases I invariably treat with mercury, but have lately employed the mercury in combination with iodine and arsenic, under the form of Donovan's solution.

The tubercular form of the venereal disease comes next in order, and usually presents itself as acne, constituting a distinct, hard, inflamed tubercle, having a tendency to slowly suppurate. The tubercles appear especially on the forehead, face, neck, and shoulders, but rarely attack the lower parts of the trunk. Their specific characteristic is, as in the other kinds of eruption, indicated by a peculiar dusky colour: the venereal taint is, however, sometimes very difficult to distinguish, when the eruption appears in those whose constitutions have been broken down by hard drinking; and the diagnosis is important, as mercury is the appropriate remedy when the disease is influenced by the venereal poison, but quite inappropriate when the disease appears as a consequence of dissipation. Lastly, there are two other forms of venereal cutaneous disease, but these have generally been considered as tertiary in character, although I confess that I do not distinctly understand what is meant by "tertiary symptoms;" but if it be true that these eruptions be neither capable of being propagated by inoculation nor hereditarily, they deserve a distinct place in the category of venereal disease: the eruptions to which I allude are impetigo and ecthyma of the pustular, and rupia of the vesicular order. These diseases are not to be treated by mercury, but by iodine and the iodide of potassium, and when the vital powers of the patient are greatly diminished, bark and the mineral acids are indicated; but generally change of air, especially that of the sea-side, seems to prove the most effectual remedy; at the same time iodide of potassium ought again to be given when the constitution of the patient is sufficiently restored.

Ulcers upon the tongue sometimes form under the action of secondary syphilis, and are often not only difficult to cure, but likewise to diagnose. In one or two cases I have seen a most unhealthy kind of ulcer follow venereal symptoms, and put on the characters of a malignant sore even to the hardness and eversion of the edges, and lancinating pain. If the patient were youthful, and, above all, if there were present any symptoms which could be referred to syphilis, I should be led to give mercury to gentle ptyalism, more especially if there were no constitutional appearance of a tendency to malignant disease. In some cases I have found the mercury produce a very good effect, and where such a disease does not yield to the ordinary treatment I think mercury ought always to be tried before the disease were removed by operation, for I think it will generally be found that the extirpation of a malignant ulcer from the tongue only hastens the fatal termination of the disease.

I have already mentioned that, among other tissues, the iris is subject to be affected by secondary syphilis. Iritis from this cause differs in no marked respect from that which arises idiopathically, but the disease is probably more severe, and the symptoms are more rapidly developed. Syphilitic can only be distinguished from idiopathic iritis by the general history of the case, and by the presence of other circumstances and symptoms that indicate the existence of a specific taint in the constitution; the appearance and local circumstances of these varieties of iritis are exactly similar, but the common iritis produces no constitutional disturbance. Slight pain and redness, sometimes extending to the forehead, temple, and cheek, are usually the first symptoms of iritis, and there is often a great intolerance to light, and an abundant flow of tears, but this is not an invariable symptom; dimness of vision is another sign of this disease, and as it advances the dimness of sight increases until even perception of light is lost. The iris loses its brilliancy, and acquires a dull appearance; its sensibility is also impaired, so that the pupil does not contract and dilate with its normal facility or regularity. The principal diagnostic mark of iritis, is, however, a zone of vessels around the margin of the iris. These vessels are so numerous, that they have the appearance, unless minutely examined, of a red band, but upon closer examination, it will be found that they are closely compacted straight vessels, converging to the centre from the orbital margin of the eye; the colour of this zone differs in depth according to the stage of the disease, sometimes the red zone does not immediately surround the iris, but is separated from it by a grey line, which in some cases embraces the whole circumference of the iris, while in others it is but partial. As the disease gains power, the appearance of the iris is more changed, the pupil becomes irregular in form, adhering partially to the capsule of the lens. The aqueous membrane gets more or less opaque, and fibrinous tubercles are formed on the iris, generally near the pupil; these tubercles are at first of a light yellow colour, but become darker, or more orange-tinted; usually a kind of general deposition of fibrin takes place before the formation of distinct tubercles, and if the eye were originally grey or blue this fibrin alters the colour to a greenish hue. In severe cases it often happens that the tubercles suppurate and discharge the pus into the anterior chamber, constituting the condition termed onyx. Mercury is here, as in the other manifestations of syphilis, the only remedy to be relied on, and in an early stage of the complaint will generally stop its progress readily. Mercury not only subdues the inflammation; but likewise causes the absorption of the fibrinous matter so frequently deposited upon the iris in this disease. The mercury is best given in combination with opium, to prevent its action on the bowels: the secretions should, however, be kept up, and the diet ought to be moderate. Extract of belladonna should be rubbed into the eyebrow, to cause dilatation of the pupil and prevent adhesion between the pupillary margin of the iris and the capsule of the crystalline lens. If the iritis be acute the mercury should be increased in quantity, as the object is to produce the mercurial influence as rapidly as possible, for upon that the arrest of inflammation depends entirely. I generally give a grain and a half of calomel and a quarter of a grain of opium every six hours until tenderness of the gums is produced, and if there be great intolerance to light, excessive effusion of tears, and deep-seated pain in the globe of the eye itself, I apply a few leeches on the temple and a blister behind the ear on the affected side. There is no syphilitic disease in which mercury seems to act so specifically and rapidly as in iritis.

Of the diseases of the bones which are said to result as a secondary effect of syphilis, I can only remark that I have for years doubted the truth of the doctrine itself, as I have never known the bones to become diseased unless mercury had been exhibited; and I can hardly bring forward a better proof of this than the fact, that in former times, when such enormous quantities of mercury were given for the cure of syphilitic disease, the affections of the bones were almost as common as syphilis itself; while now, on the contrary, when the employment of mercury has been so judiciously modified, diseases of the osseous system are but of rare occurrence.

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